NUMBER 81 OCTOBER 1944

# THE BULLETIN

OF THE

## U. S. Army Medical Department

A periodical containing original articles, reviews, news, and abstracts of interest to the Medical Department of the Army

ISSUED UNDER THE AUSPICES OF
THE OFFICE OF THE SURGEON GENERAL



PUBLISHED MONTHLY AT THE MEDICAL FIELD SERVICE SCHOOL,
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NORMAN T. KIRK
Major General, U. S. Army,
The Surgeon General.

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# Foreword

With the October 1943 issue, The Bulletin became a monthly periodical, instead of a quarterly, dedicated to keeping the personnel of the Medical Department informed on developments in war medicine. The new publication, known as The Bulletin of the U. S. Army Medical Department, absorbed the former quarterly dental and veterinary bulletins and will have material devoted to those fields in each issue.

The Bulletin is intended to be educational rather than directive in nature. It will contain the best information obtainable concerning military medical experience, observations, and procedure that may help to improve further the quality of professional services. The Bulletin will be a medium whereby experience gained in one theater of combat may be shared with those serving in other combat areas and with those in this country who are preparing for overseas duty. News items concerning military and scientific developments as well as original articles will be emphasized. The Bulletin, however, should not serve as a basis for the forwarding of requisitions for equipment or supplies referred to therein.

Obviously, some of the most interesting field experiences cannot be divulged in a periodical of this kind when our country is at war. The Bulletin will, however, publish that which can be safely told, drawing not only on current literature, but on many authoritative reports which reach The Surgeon General's Office from the field. Officers are invited to submit for publication reports of their field experiences that can profitably be shared with other officers.

The Medical Department has been commended for its work in caring for the sick and wounded in theaters of operations in war. The Bulletin will endeavor to stimulate such progress and to advance further the high standard of medical service in the Army of the United States.

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# Notice to Contributors

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# News and Comment

## ADDRESS BY THE SECRETARY OF WAR

**I have just returned from a three weeks' trip to the fighting fronts in Italy and France. To say that it was inspiring is to understate one of the most significant experiences of my life. In the short time that was available I covered a great deal of ground and saw and talked to many soldiers and their principal commanders. As a result of my crowded and rapidly moving journey, one outstanding point is clear. The people of the United States have fighting for this nation abroad the most efficient, aggressive, and potentially powerful force on the ground, on the sea, and in the air that history has seen. We think we know the human element of this army, but few of us here would recognize the skilled, relentless fighters that are the product of our homes. They are bronzed, physically fit, and confident.**

**When they are hurt, they have the assistance of an extraordinarily effective medical service, which embraces more than medical science. The fight for the soldier's life begins the minute he is hit. It is carried on by medical personnel in the aid stations on the very battlefield itself, then in the evacuation hospitals, utilizing every aid of modern medical science and constantly inventing new surgical methods. These efforts have raised the life expectancy of our wounded to an amazingly high figure. The attitude of these wounded men will always be, to me, unforgettable. It should be so to every American no matter what his adversity. I have yet to see one of the wounded whom I have met—many of them gravely hurt—who whined or whimpered. I have yet to see a single one who did not try to smile and shake my hand.**

**I believe I know my countrymen and countrywomen well enough to realize that none of them will want to carry on his conscience the knowledge that any action or inaction on his part will weaken the superb fighting spirit of our soldiers, or deny to them the constant replacement of men and equipment that they must have in order to maintain their offensive. It is inconceivable that anyone of us can fail those splendid men I have just seen on the battlefields and in the hospitals and those whose honored names are written on the ordered white crosses in foreign fields.**

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Abstract of a radio address delivered by the Honorable Henry L. Stimson, Secretary of War, at The Pentagon, Washington, D. C., 25 July 1944.

## THE CARE OF WAR WOUNDS

The proper surgical approach to the ever-present subject of war wounds is expressed clearly and concisely in the following extracts from a report of an evacuation hospital in the Southwest Pacific Theater.

The primary surgical treatment of wounds still stands as of foremost importance in war surgery. In 1941, W. D. Gallie wrote that the skill of the surgeon is of prime importance in the surgery of war, and nowhere is it of such great importance as in the *first* treatment of the wounded.

In 217 battle casualties admitted to this evacuation hospital during one campaign there were 293 wounds requiring major surgery. Four of these patients died, a mortality of less than 1 percent. Only two patients developed wound infections while under our observation, and these were not of a serious nature. No patient developed gas bacillus infection either before or after evacuation.

*In short, the routine treatment of the wound consisted of adequate débridement, gentle handling of tissues, the minimum use of sutures that ensured hemostasis, removal of accessible foreign bodies, refusal to close primarily a wound no matter how tempting, oral sulfonization, loose packing of wounds, and adequate immobilization.*

Faulty judgment in débridement should be made on the side of too much rather than too little removal of tissue. Second in technical importance is the gentle handling of tissues, a well-accepted Halstedian maxim that is too often and too easily forgotten in the heat and excitement of caring for a large number of casualties. The use of massive ligatures that burden reparative processes is interdicted. The finest catgut, preferably double or triple O, should be used exclusively for hemostasis except when dealing with major vessels. Accessible foreign bodies should be removed, but undue, enthusiastic exploration and probing may well do more harm than good. This is particularly true in the wound with multiple bits of shell fragment. Occasionally, removal of a sizable single fragment through a counter incision may be preferred to the traversing of a long, little-traumatized tract.

Systemic administration of sulfonamides should be routine, sulfadiazine being the drug of choice. Under no circumstances should sulfathiazole be used locally in intracranial injuries. Pilcher has shown that not only is the absorption of sulfathiazole poor, but also a high percentage of focal epilepsy follows its application to the meninges. The hazards of too tightly packing a wound, namely, incarceration of secretions and the compromise of the blood supply to adjacent tissues, should be obvious and require no particular comment.

*The primary closure of wounds in the field is still being practiced on occasion in spite of the many warnings and direc-*

Prepared in the Surgery Division of The Surgeon General's Office.

*tives to the contrary. During a recent campaign in another theater, in which there were approximately 600 battle casualties, sixteen patients developed gangrene, several of whom had wounds primarily closed. Other isolated cases of Welch's bacillus infection have been seen, following the same practice. Although in civilian practice many wounds may be safely closed, in field surgery, because of early evacuation of patients and the difficulties of maintaining the strictest aseptic technique, primary closure is not only impractical but dangerous.* Early secondary closure offers possibilities that as yet have not been fully explored in this theater, although in the last world war its successful use was reported and advocated by Heuer.

Immobilization of injuries of both the bones and soft tissues, as emphasized by Orr and Trueta, has proved its worth. The many advantages may be summarized: it affords maximum rest thus providing optimum conditions for healing, reduces pain, permits easy elevation of the injured extremity, discourages unnecessary dressings, and facilitates transportation of the wounded.

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### TREATMENT OF CASUALTIES DUE TO LUNG IRRITANTS

Among chemical warfare agents, the important lung irritants are phosgene, chlorine, chlorpicrin, and nitrous fumes. Phosgene and nitrous fumes exert their primary effect on the parenchyma of the lungs, whereas chlorine and chlorpicrin are most likely to injure the trachea and bronchi.

The treatment for casualties resulting from exposure to any of the lung irritants is essentially the same. When respiratory distress occurs on moderate exertion, the patient should be put at rest, but until this distress occurs, casualties may be evacuated by walking. Men should not be relieved of their duties until definite symptoms appear. The application of heat to casualties due to lung irritants should not be carried out too enthusiastically. The patients should be kept only comfortably warm.

Anoxia, indicated by cough, dyspnea, cyanosis, and restlessness, should be treated by the administration of oxygen in as high a concentration as possible. Carbon dioxide and oxygen mixtures are not indicated. Should oxygen fail to comfort the patient, morphine in doses up to ¼ grain may be used cautiously at the discretion of the physician, who must weigh its sedative effect against respiratory depression. Codeine may be of greater value in cases where cough is the prominent symptom. Barbiturates are of no value.

There is no evidence that venesection, which was performed frequently on lung-irritant casualties in World War I, is of any value. It is definitely harmful in the shocklike state. Sulfonamides may be given in appropriate doses and with proper precautions for the prevention and treatment of pulmonary infections which frequently occur secondarily. When

the irritation is limited to the upper respiratory tract, expectorants may be of value in relieving cough. They should not be used in the presence of pulmonary edema.

Many agents which have been tried in the treatment of phosgene and other lung-irritant casualties have proved ineffective and, indeed, harmful. These include atropine, blood plasma, and cardiac and respiratory stimulants such as adrenalin, ephedrine, benzedrine, coramine, and metrazol. Alcohol is contraindicated.

Most deaths occur within the first forty-eight hours after exposure to the lung irritants. The few deaths which occur following this period are generally due to bronchopneumonia.

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### TREATMENT OF SHOCK RESULTING FROM LOSS OF BLOOD

The most physiologic and effective therapy in shock resulting from blood loss is whole blood transfusion, whereas in conditions in which plasma loss has occurred, such as burns and shock not due to blood loss, the most rational and physiologic therapy is plasma transfusion.

The widespread use of plasma during this war for the treatment of shock represents one of the great advances in war surgery. The fact that, once prepared, it can be kept under almost any condition for indefinite periods of time has made this fluid a most valuable material for the therapy of shock under circumstances where whole blood is not indicated or, where indicated, is not immediately available. However, this widespread use has resulted in a misconception by some medical officers, particularly those inexperienced in the surgery of trauma, of the true role of plasma in shock therapy and in war surgery. *When whole blood is not available, plasma is the best fluid for the treatment of shock resulting from blood loss.*

A patient in shock resulting from hemorrhage suffers not only from a reduction in blood volume but also from a diminution in the oxygen-carrying capacity of his blood due to the reduced number of red cells. The result of the loss of red cells is a tissue anoxia which tends to perpetuate the vicious cycle of increased capillary permeability followed by further reduction in blood volume and more pronounced anoxia. Prompt and adequate transfusions of whole blood in such cases restore not only the blood volume but also the oxygen-carrying capacity of the blood to normal, thereby combating tissue anoxia with its potentially hazardous consequences.

It has been repeatedly noted that patients in hemorrhagic shock, prepared for surgery by plasma transfusion alone, frequently deteriorate into a state of shock as profound as that noted prior to plasma therapy. On the other hand, when adequate whole blood transfusions have been used, surgery is well tolerated without the degree of deterioration noted in patients prepared with plasma. By using transfusions of whole blood, par-

ticularly in resuscitation prior to operation and during operative procedures, many patients have been saved who otherwise because of their "unsteady state" would not have tolerated the surgery which was indicated. It is important for medical officers to understand that in the therapy of hemorrhagic shock plasma represents the measure which effects immediate survival of the patient until he can be stabilized and brought into more complete physiologic equilibrium by whole blood transfusion at installations where blood is available and its administration practicable.

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### SODIUM AMYTAL IN THE MANAGEMENT OF DEPRESSED AND NEGATIVISTIC PATIENTS

Major Samuel W. Joel, M. C., reports that obstacles to the successful management of neuropsychiatric cases, notably the catatonic and negativistic reaction types and less notably manic-depressive reaction types, frequently can be overcome by small intravenous doses of sodium amytal (sodium isoamyl ethyl barbiturate) which produce a stimulating effect. These obstacles are: the patient's "refusal" to take nourishment, loss of bladder and rectal control, and the difficulties encountered in administering drugs which may be necessary in treating complications.

Refusal to take nourishment is usually overcome by tube feedings or intravenous administration of nourishing fluids, or a combination. Except in well-equipped hospitals these methods are time-consuming, difficult, and not without danger of complications. These objections are also raised where provision for the proper care of the bladder and bowels is by means of catheterizations and enemas. Finally, routine care in some cases is almost impossible when cooperation of the patient is lacking.

Sodium amytal, as usually given orally, rectally, intramuscularly, or intravenously, produces a sedative effect; however, when injected slowly, small doses given intravenously produce a stimulating effect. This arouses the patient from his stupor in the catatonic and negativistic reaction types and lessens the depression in the manic-depressive reaction types. The patient becomes accessible, answers questions, follows suggestions, and obeys orders. The effect will vary and will last from one-half hour to three hours. During this period, it is suggested that nourishment be offered the patient, that proper attention be given to his bowels and bladder (he will usually voluntarily void and defecate), and that any other necessary procedures requiring the cooperation of the patient be carried out. The author has found this procedure very satisfactory. In one case of acute catatonic stupor treated by one daily intravenous stimulating dose of sodium amytal for sixteen consecutive days, the patient was nourished and all personal needs cared for. During this

period he gained five pounds in weight. The treatment was discontinued when he began spontaneously to eat and care for himself.

The dosage found necessary to produce the stimulating effect is about 0.3 gm. (4½ gr.). The package containing the 0.5 gm. (7½ gr.) ampule of sodium amytal and an ampule containing sufficient distilled water to make a 10 percent solution is recommended for convenience and economy. The rate of intravenous injection should not exceed 1 cc. (0.1 gm.) per minute. After 1 cc. to 1.5 cc. have been injected, a general muscular relaxation is observed. From here on, the patient should be constantly questioned to enhance the stimulating effect of the drug. When this effect is reached, he begins to wake up, move about, and talk. The injection should be discontinued at this point, because the margin between stimulation and sedation is narrow and further administration of the drug will be sedative in effect.

Before using the drug, the medical officer should familiarize himself with the care necessary in preparing the solution, the contraindications, and the side effects. However, because the dose necessary to produce the desired effect is small, the drug is a safe one to use. After practice with the drug, the desired effect is easier and more frequently obtained. Some patients, however, will not respond. It is a valuable drug and worthy of trial before extensive and frequently difficult procedures are carried out to maintain the patient's health while awaiting evacuation to a general hospital.

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## SPECIAL STUDY OF FILARIASIS

The War Department announced on 2 August that 522 members of the 134th Field Artillery Battalion, exposed to filariasis in the South Pacific, had arrived in the United States and were at Camp Atterbury, Indiana, where the convalescent facilities of Wakeman General Hospital are available to them. While all of these men have been under observation for filariasis, in only a small percentage has the disease been established, and their condition is not serious. They were evacuated after a comparatively short exposure to filariasis, and there seems little likelihood that the more serious permanent consequences, including elephantiasis, will develop.

Transmission of filariasis is possible only when immature forms of the parasite (*Wuchereria bancrofti*) are circulating in the blood of an infected person. Such larval forms, which must be taken up by a mosquito in order to complete their development, have not been found in the blood of any of the returned soldiers. There is no risk, therefore, that they will spread the disease in this country. Most of the men will receive furloughs and then return to the convalescent hospital. It is expected that the majority will return to duty within a short time.

## PROCESS FOR LAUNDERING WITH SEA WATER

A few months ago the Laundry Section of The Surgeon General's Office discovered that very few hospital ship laundries would be able to operate because of the shortage of fresh water. On most hospital ships, when the laundry was in operation, the supply of fresh water was insufficient for the ship's personnel and it had to be rationed. Normal washing processes involve water ranging in hardness from 17 to 50 parts per million; sea water usually has a hardness of about 21,000 parts per million.

After experiments had been made, a process was eventually devised which appeared satisfactory. Experiments in the process were directed by Major (now lieutenant colonel) H. F. Wiley, A.U.S., of The Surgeon General's Office. The Occupational Health Division observed the new process and decided that no primary skin irritant was present in the washed linen as a result of the process. When the washed linen was put to use, no skin irritations were reported.

The United States Army hospital ship *Wisteria* was then selected for a practical test at sea, and in a thirty-day period 36,101 pieces were successfully laundered with sea water. The commanding officer of the ship's medical complement reported that the quality of the laundry was excellent and that no dermal lesions due to the process were reported.

All Army hospital ships now are to be equipped with this sea-water washing process. Savings in fresh water will be tremendous. Savings in space which might otherwise be occupied by fresh-water evaporators will be considerable. Extension of this process to other ramifications in the use of sea water to conserve fresh water is under consideration.

The *Wisteria* on her maiden voyage thus accomplished the first successful washing of linens in a standard laundry on a hospital ship, using sea water instead of fresh water.

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## INDIVIDUAL REPORTS OF MALARIA

The military importance of malaria makes necessary the careful collection of all data which might be helpful in the control or management of the disease. The relapsing character of malaria, especially when it is of the vivax variety, renders the interpretation of the usual epidemiologic statistics uncertain, since primary attacks and relapses are not separated. In malarious regions the possibility of reinfection is an additional difficulty.

In order to improve available knowledge of the number of individuals with malaria and of the number of clinical attacks individuals undergo, a special report was instituted on 5 January 1944 for Army Service Forces units in the United States (control approval symbol MCB-93). Each clinical attack of malaria (and not only each patient with malaria) is to be reported separately, using W.D., M.D. Form 52. Reports should be plainly labeled "Malaria Report"

and transmitted by the usual channels within ten days of the diagnosis of the attack. For this purpose, a clinical attack may be defined as the association of a temperature of 100° with malarial parasitemia. In addition to the usual identifying data, among which the name and serial number of the individual are essential, the following information is to be supplied:

1. Origin of the infection, designated as United States, or Caribbean, South Atlantic, Central Pacific, South Pacific, Southwest Pacific, Middle East, Asiatic (China-Burma-India), North African (including Italy), or European Theater of Operations.

2. Date of first attack of malaria since entering current military service.

3. Number of previous attacks of malaria since entering current military service.

4. Date of onset of present attack of malaria.

5. Diagnosis of attack proved or not proved (by blood smear).

6. Type of malarial parasite or parasites present in this attack (*vivax*, *falciparum*, *malariae*).

7. Antimalarial drug or drugs used in present attack (dose is not required).

8. Number of days of fever in present malarial attack.

This report is entirely distinct from the regular return of W.D., M.D. Form 52 prepared for the monthly Sick and Wounded Report and should be transmitted separately from it.

Data from the new reports of malarial attacks will be analyzed with care. They are expected to yield valuable information, especially with reference to the evaluation of the long-term results of treatments, and to the number of individuals in whom clinical activity recurs once, twice, and so on, and as to the length of time during which relapses occur in individual cases. The continued cooperation of all medical officers in care of patients, especially with ward officers and registrars of hospitals, is necessary for the success of this plan. It is hoped that overseas areas in which malaria is a problem, may gather similar data, at least with reference to individuals removed to nonmalarious regions.

To prevent waste of time and effort, medical officers are reminded that the use of the malarial register (M. D. Form 56) was discontinued by section I of War Department Circular No. 79, 6 October 1939, rescinding paragraph 2*e*(3) of AR 40-230, which previously required the use of this form. It is unnecessary to transmit old copies of the malarial register.

Attention is also invited to the fact that paragraph 3 of S. G. O. Circular Letter No. 111, 5 June 1943, relating to reports of examinations for malaria in groups of individuals returned from overseas, has been rescinded (section IV, paragraph 40*c*, S.G.O. Circular Letter No. 1, 1 January 1944) and that it is no longer necessary that such reports be transmitted.

## CIVILIAN DENTAL CONSULTANTS

The Dental Division of The Surgeon General's Office has been considering the appointment of a number of nationally known dental practitioners as civilian dental consultants, to assist the Army Dental Corps. Major General Kirk, The Surgeon General, has approved the plan. The dentists who are in the process of being appointed will be designated in the fields of oral surgery and prosthetics. While operative dentistry and periodontics are equally as important as the subjects selected, the major problems of the Dental Corps have been associated with oral surgery and prosthetics.

The civilian consultants, who under contract with the War Department will be ordered to duty for one or more days at a time, will observe the activities and functions of the oral surgical or prosthetic sections and recommend certain modifications in procedure whereby the respective services may be improved and made more efficient. The consultants will give demonstrations and lectures as they may deem necessary. All instruction is to be consistent with the over-all Army policies and the facilities at hand. Comparatively few of the country's outstanding oral surgeons and prosthodontists will be afforded appointments, since the selection is limited in number and within certain geographical limits of the United States.

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Base surgeon's office in New Guinea.

### HUNDREDS OF HOMEMADE WASHING MACHINES

Homemade washing machines dot the beaches of the Central Pacific islands, where everybody from general to private does his own laundry and wears it roughdried, according to Lieut. Colonel George Blakeley, deputy commander, Seventh Air Force Bomber Command. With the campaign moving from island to island, laundry became a problem. "We took a 5-gallon oil can, cut off the top, and made a crude windmill above it. The windmill was hooked to a drive shaft which caused a wooden paddle to churn up and down in the barrel filled with water, soap, and dirty clothes. An hour or so of churning* leaves the clothes free of dirt picked up in combat. I've seen Brigadier General Truman H. Landon, commander of the Seventh Bomber Command, up at 5 a.m. many a morning doing his laundry. The soldiers take their washing machines along as they move forward."

Colonel Blakeley said he has seen as many as 400 of these homemade washing machines strung out along the beaches after the enemy was chased out. He has operated his own private washer on Funafuti, Tarawa, and Kwajalein as the headquarters of the bomber command moved forward. In World War I, Colonel Blakeley piloted French- and English-type bombers in France. He re-entered the Army in 1942 and has been with the Seventh Air Force since May 1943.

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### CENTER FOR TREATMENT OF TROPICAL DISEASES

A center for the study and treatment of tropical diseases encountered by American troops was opened 1 September at the Moore General Hospital, Swannanoa, North Carolina. There are 350 beds for patients under active treatment and barrack facilities for 1,100 men for the reconditioning program. When a man is released from bed treatment, he is transferred to the reconditioning barracks, where any further treatment required is continued while he is in training needed to fit him for active duty again.

It is proposed to concentrate at the new center, as far as possible, all tropical disease patients in the Army, particularly those having malaria and filariasis. Facilities are being provided for expansion of the bed capacities as required and for training Army medical officers in the treatment of tropical diseases.

The new center will be under the supervision of Lieut. Colonel Francis R. Dieuaide, chief, Tropical Disease Branch of the Medicine Division of The Surgeon General's Office. The commanding officer will be Lieut. Colonel Joseph M. Hayman of Cleveland, who spent two years in the South Pacific studying tropical diseases.

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*An improvised washing machine which apparently does the work in much less time was described in The Bulletin, April 1944, page 35.

## NEURITIS ASSOCIATED WITH MALARIA

Reports have been received concerning two forms of neuritis associated with malaria observed in a general hospital in a tropical theater. Harvey and his associates describe[1] a syndrome in twenty patients interpreted as due to a peripheral lesion, usually unilateral, most commonly affecting the common peroneal nerve but sometimes the axillary nerve. The onset usually was sudden. Manifestations were predominantly motor in nature: muscular weakness, paralysis, and atrophy. Pain was unimportant except when the axillary nerve was involved. Sensory loss was sufficient in half the cases to cause a complaint of numbness. Only one-half the cases were related to malaria, (usually due to *Plasmodium vivax*) and attacks of malaria after appearance of the neuritis did not accentuate neuritic symptoms. In this group, malaria is believed to have a nonspecific role in the causation of neuritis and the specific etiology is unknown. A tendency toward slow recovery was observed. These cases are similar to those described by Spillane.[2]

Harvey describes a second group of patients[3] with neuritis, the manifestations of which are segmental rather than peripheral, usually bilateral and symmetrical and which, he suspects, are caused by vascular lesions attributable to malaria. The syndrome in its severe form is highly characteristic because of three manifestations of nervous tissue irritation: excessive skin sensitivity, localized visible sweating, and increased muscle tone, frequently with visible contraction of affected muscles, which lasted for two or three days. The forearms and hands usually were involved. Weakness of affected muscles was not striking and was difficult to evaluate because of pain. In the majority of cases, the onset was related to the first or second attack of malaria, but in a few instances began as late as the fifth attack. Not only was onset of the syndrome related to attacks of malaria, but attacks of malaria subsequent to onset of neuritis were associated with aggravation of neuritic manifestations. The malaria parasite usually identified in this group was *P. vivax*, but the existence of falciparum infection before the patients were studied in the general hospital is not excluded. Falciparum infection was common in the military organizations from which these patients came. Manifestations believed to represent a milder form of the same kind of neuritis were almost entirely sensory. One or more extremities "went to sleep" easily and were the seat of frequent attacks of numbness and tingling. Pain of root distribution was frequently the first

An abstract prepared in the Medicine Division of The Surgeon General's Office.

1. Harvey, A. M., Kuffler, S. W., and Tredway, J. B.: Peripheral Neuritis: Clinical and Physiological Observations on a Series of Twenty Cases of Unknown Etiology (to be published).

2. Spillane, J. D.: Localized Neuritis of Shoulder Girdle, Lancet, Lond., 2:532-533, 30 Oct. 1943.

3. Harvey, A. M.: A Type of Neuritis Associated with Malarial Fever (submitted for publication to the Bulletin of the Johns Hopkins Hospital).

manifestation and sometimes involved the lower thoracic segments, resulting in intense symptoms in the abdominal region. Other nerves frequently the site of severe neuralgia were the trigeminal, sciatic, and axillary nerves. Accompanying the pain were the sensation that the region was being pricked with needles and a feeling of tightness in the muscles. Often many nerve roots were involved and the manifestations usually were bilaterally symmetrical. Localized sweating was a valuable diagnostic sign. With suppressive antimalarial therapy with atabrine, recovery was the rule. The importance of differentiating this syndrome from psychosomatic disorders is apparent.

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### DIMETHYLPHTHALATE POISONING

A case of dimethylphthalate poisoning has been reported by Major Paul C. Doehring, M. C., and Captain Andrew S. Albritton, M. C., of a portable surgical hospital in New Guinea. A soldier, aged 27, applied to his aid man for mineral oil and was given an ounce of what appeared to be mineral oil from a bottle which was labeled as such but which subsequent laboratory analysis proved to be a bottle of insect repellent. The bottle was sent to a unit for analysis of the contents. The commanding officer, Major Thomas A. Hart, Sn. C., reported that the contents of the sample sent was "insect repellent. Trade names vary ('Ever Ready,' 'Skat,' '612,' etc.). The active ingredient of this repellent is dimethylphthalate."

After two hours, the soldier began to stagger, said he felt drunk, and was nauseated. He vomited, fell to the ground, and rapidly passed into a coma. On arrival at the portable surgical hospital about two and one-half hours after ingestion of the repellent, he was in a deep coma and all muscles were flaccid. A strong odor of dimethylphthalate was on his breath. His skin was warm, dry, and pink. Pupils were equal and reacted to light. Tendon reflexes were normal. Pulse was 100 and of good quality. Blood pressure was 94 mm. systolic and 70 mm. diastolic. Temperature was 98° F. and respiration 18 per minute and regular. There was a first-degree burn of his lips and buccal mucosa.

Within an hour after admission he regained consciousness and began to vomit. His temperature rose to 102.6°. A stomach lavage of sodium bicarbonate was given by tube and 1,000 cc. of 5 percent dextrose in normal saline solution was given intravenously, together with 5 grains of caffeine and sodium benzoate subcutaneously. His condition improved rapidly. Later in the day he developed diarrhea. About six hours after admission he was more or less normal, except for a burning sensation of his lips, tongue, and mouth, anorexia, mild nausea, abdominal soreness, and a diminishing diarrhea; his temperature was normal. On a bland diet, subsequent re-

covery was uneventful and the patient returned to duty five days after admission.

This bottle of insect repellent was taken in the battalion aid station from a M.D. Chest No. 2 which had been picked up along the trail, apparently having been dropped a few days earlier by a preceding unit. Inquiry of all concerned failed to reveal how the bottle had become mislabeled.

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## REGISTRY OF VETERINARY PATHOLOGY

The Surgeon General and the Board of Governors of the American Veterinary Medical Association have approved an arrangement for establishing and maintaining a Registry of Veterinary Pathology at the Army Medical Museum, Washington, D. C. This registry will become a unit of the American Registry of Pathology, an organization operating by authority of The Surgeon General under the sponsorship of the National Research Council. The purpose of the American Registry of Pathology is comprehensive investigation in certain special fields. Through cooperation with various national societies, records and material are brought together for systematic study. The material and the records of the Registry are available to graduate students, specialists, and other authorized persons, for study.

It is desired to assemble for the Registry of Veterinary Pathology: (1) material representing general pathologic anatomy, including vitamin deficiencies, specific diseases of different tissues and organs, and examples of natural and experimentally induced neoplasia; (2) a complete collection of prepared slides representing the normal histology of the different species of animals, including domesticated and wild mammals, birds, and cold-blooded vertebrates; and (3) material illustrating experimentally induced lesions of infectious diseases. As material accumulates, loan sets of slides will be made available for study. Similarly, sets of lantern slides pertaining to topics of special importance also will be available for loan to contributors.

It is hoped that veterinarians and others interested in comparative pathology will make full use of the Registry and send to it material of interest for teaching and for the investigation of animal and human diseases. Material submitted should be addressed to: The Director, Army Institute of Pathology, Army Medical Museum (Attention: Registry of Veterinary Pathology), 7th Street and Independence Avenue, SW., Washington 25, D. C. The director will gladly furnish further instructions to contributors for submission of material. The special committee on the Registry of Veterinary Pathology includes: Dr. W. H. Feldman, Mayo Foundation, chairman; Captain Charles L. Davis, V. C., Army Institute of Pathology; Dr. Harry W. Schoening, chief, Pathological Division, U. S. Bureau of Animal Industry; and Lieut. Colonel Balduin Lucké, M. C., deputy director, Army Institute of Pathology, member ex officio.

## FURTHER DEVELOPMENTS IN PLANS FOR THE MEDICAL HISTORY OF WORLD WAR II

*The Bulletin* in June 1944 published an article entitled "A New Approach to the Medical History of World War II," in which the development of the historical programs of the Subcommittee on Historical Records of the National Research Council and of the Medical Department of the Army was discussed. The former program was initiated in June 1940 and the latter in August 1941.

The series of volumes proposed by the Subcommittee on Historical Records was to be devoted primarily to the professional aspects of military and civilian medicine in World War II. The Medical Department's initial program provided for cooperation with the National Research Council in its program and for the preparation of additional volumes to cover military preventive medicine and Medical Department organization, administrative, and supply activities. The division of responsibility continued until March 1944. Appreciating then the responsibility of the Medical Department to record its valuable world-wide experience, Major General Kirk, after discussing the subject with his professional staff, directed that the Medical Department assume full responsibility for the preparation of volumes covering both its professional and administrative activities.

This decision was based primarily on two factors: (1) the size and multifarious duties of the Medical Department organization, and (2) the advantage of having historical volumes written by medical officers with firsthand experience in the various professional and administrative specialties. It was felt that only those having such experience could write with authority. Another great advantage of the Medical Department's assuming the responsibility for an account of its entire experience is that the arrangement permits integration of all volumes in one series. Furthermore, as was stated in *The Bulletin* article, the Medical Department, in addition to its moral responsibility to record accurately its experience gained at so tremendous a price, has received directives from higher authorities to do so.

It is apparent that the Department has the organization and officers who are eminently qualified to do a splendid job. All are being encouraged to participate in the effort, and those who are specially qualified by training or position are being asked to make special contributions. In addition, the advice and assistance of qualified professional men in civil life will be requested.

When the plan was discussed with representatives of the National Research Council on 1 April 1944, it was agreed that that organization should continue its historical program on the presumption that it would be restricted to a synthesized account of the experience of official and civilian medical agencies. To enable the National Research Council to gather information concerning Medical Department activities from those having experi-

From the Historical Division of The Surgeon General's Office.

ence in the field, it was understood that individual Medical Department officers might be asked by editors of the National Research Council volumes to contribute with the understanding that in doing so they would not be discharging an official commitment to the Medical Department's historical program. Hence, in the letter, to officers of the Medical Department and signed by The Surgeon General, that appeared in the September issue of *The Bulletin*, a statement was included with reference to the contributions of individual Medical Department officers to the National Research Council series.

It appears now that all aspects of the subject were not fully explored. Although many have felt that National Research Council and Medical Department professional volumes could be prepared without overlapping, it is now evident that the story of medicine during this war is in such a large measure based on Army experience that two series of such volumes cannot be written without overlapping. This has become increasingly evident since often the same Medical Department officers have been, or may be, asked to write for each of the series. Such overlapping and paralleling would detract from the professional interest in each of them. In addition, contributing to the two series would impose unnecessary work on busy officers.

Although The Surgeon General appreciates very much the unselfish interest and efforts of the many patriotic physicians and scientists in the development of the National Research Council program, he has expressed the opinion that it should be radically revised to eliminate all accounts of Medical Department activities in this war, until such experience has been published in the official history. Thus in a recent letter to the chairman of the Division of Medical Sciences of the National Research Council, he said: "It is my firm conviction that the National Research Council program should be revised radically to eliminate all accounts of Medical Department experience in this war. Your Committee has a very large field of medical and scientific activities to cover without attempting to duplicate a record of Army medical activities."

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Two component units of the mobile dental laboratory. The vehicle on the left is the laboratory. The one on the right is the dental clinic. England, 2 December 1943. Signal Corps photograph.

## WAR-TIME GRADUATE MEDICAL MEETINGS

American medicine has pooled its teaching resources and made available to medical installations of the armed forces, at no cost to the Government, advantages for continuous medical education through the War-Time Graduate Medical Meetings. The deans of medical schools have offered names of qualified members of faculties to work with thirty-four National Consultants and the National Faculty, organized by the National Consultants, to give courses which should benefit all doctors in uniform today. Shortening the training period from four to three years and the intern period from two years to nine months increased the need for a follow-up program of continued instruction in the various fundamentals of medicine. The officials of the American Medical Association, American College of Surgeons, and American College of Physicians, after conferring with the Surgeons General of the Army, Navy, and Public Health Service, appointed a committee to proceed with the work of organization. The country was divided into twenty-four sections and key committees of three men were appointed in each section to carry on the details of the program. Likewise, authorities have been designated as National Consultants in the various special fields.

The National Consultants cooperate with regional committees. Each consultant is to prepare a specimen six-hour teaching schedule for a one-day period. In states where post-graduate activities are already extended in the direction of service hospitals, a committee for War-Time Graduate Medical Meetings will cooperate with the group already functioning. The teaching schedules will include ward walks, clinics, practical demonstrations, moving pictures, lectures, and conferences. The members of the Central Committee of War-Time Graduate Medical Meetings are: Dr. Edward L. Bortz, chairman, Philadelphia; Dr. William B. Breed, secretary-treasurer, Boston; and Dr. Alfred Blalock, Baltimore.

The section committees are responsible for the details of programs at each service hospital in their section, for the selection of teachers with the assistance of the Central Committee and of the National Consultants, if required, for arranging the time of meetings and the schedule of travel of teachers within their territory, for furnishing copies of programs to the commanding medical officers of hospitals, and for supervising the expenses which shall be limited to travel costs.

This program has been under way for some time. As of May 1944 the total number of War-Time Graduate Medical Meetings was 185; the total number of daily sessions, 824; the number of states in which meetings had been held, 40, and in addition 4 lectures in Canada; the number of installations where meetings had taken place, Army 107, Navy 20, civilian 13. The number of physicians then serving on the National Faculties was 1,663.

## WARM FOOD ON HEAVY BOMBERS

With the advent of the B-29, the duration of bombing missions became extended to such lengths that complete, hot meals for the men aloft became necessary. The development of a food warmer for the B-29 is described by Major Ewing W. Elliott, Q.M.C.[1]

In November 1943 a group of medical officers of a bomber command attending school at an Army Air Forces tactical center witnessed a demonstration of a forerunner of the present-day food warmer, which seemed to be the answer to part of the problem of feeding crews who are in the air a good portion of their time. Three of these units were procured for testing and many experimental flights were made. Then a conference was held in Washington at which certain modifications of the food warmer which had been tested were presented to the manufacturer, and the changes were made.

To solve problems concerning methods of preparing and packing the food, suitable menus, and mess personnel, an experimental flight mess was organized and technologists from The Quartermaster General's Office and the Chicago Subsistence Laboratories cooperated in testing menus based on components of the B ration. A school for mess personnel was established for for instruction in the preparation of in-flight foods. To eliminate any danger of keeping food in the warmer for prolonged periods of time, the Subsistence Research and Development Laboratory conducted many bacteriologic tests on foods used in the warmer. It was concluded that under ordinary conditions no greater danger of contracting food poisoning arose from the use of the food warmer in flight than existed in the regular field mess, if proper sterilization of the unit was always accomplished after use. It was learned also that the trays, beverage cups, and soup cups of the food warmer could be satisfactorily sterilized by submersion in boiling water.

1. Courtesy of The Quartermaster Review (July-August 1944, page 50), which also provided the illustration.

The forerunner of the present-day food warmer comprised a compact, electrically heated, insulated cabinet, which could be connected to a regular 115-volt electric circuit or to the electrically heated flying suit circuit on the B-29. Inside the hinged door were two compartments containing four metal trays, and in the other section was space for four canteens and a drawer for silverware and condiments. It was necessary only to pack the container with food prepared on the ground, carry it to the plane, and connect it with the electric-suit circuit. As the tight-fitting door on the container eliminates loss of moisture, any food not eaten at one feeding could be left in the container and reheated to be eaten later. Foods could be left in the food warmer as long as eighteen hours without detrimental effects. The modifications of this unit provided by the Washington conference included increasing the number of food trays to six and substituting six beverage cups and six soup cups for the four canteens.

The B-2 food warmer is now authorized for all very heavy bombers. This development, Major Elliott says, means that all combat crews will have good, warm food to quicken the hand and sharpen the mind, which may mean the difference between life and death in their battle with the enemy.

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## BACTERIAL PLATE COUNT OF MILK

In determining the bacterial plate count of milk, "Standard Methods for the Examination of Dairy Products" requires that the plating shall be completed, i. e., dilutions made, plates pipetted, and the media poured, within an interval not exceeding twenty minutes after the first transfer is made from the sample. Surveys of the milk supplies in the service commands show that this requirement is not always observed and that some laboratory technicians apparently do not fully realize its importance.

The time consumed in the plating process may markedly affect the accuracy of the plate count. Bacterial growth may take place in the diluted milk in the dilution bottle and in the plate if allowed to stand at room temperature. If the temperature of the milk at the time of plating has been allowed to increase to the extent that bacterial growth has started, the bacterial plate count of a low-count milk may increase as much as 60 percent by allowing the milk dilution to stand for fifteen minutes before it is pipetted into the plate and then allowing it to remain in the plate an additional fifteen minutes before the media is poured.

Milk samples for bacterial determinations should remain under refrigeration until the glassware, media, etc., are ready for use. The plating should then be completed without interference or delay. Furthermore, the number of samples plated at one time should not exceed that which can be completed within the required time.

## CONVALESCENT HOSPITALS

The Surgeon General's Office early in 1944 undertook a complete re-estimate of patient load and hospital facilities in overseas theaters and in the zone of interior. The objective was to discover whether or not adequate medical means were available to care for troops overseas and to ensure that evacuees could be cared for when returned to the United States. In view of the large military campaigns then contemplated, all estimates of casualties obviously would contain margins of error. These were reduced to a minimum, however, by reconciling The Surgeon General's estimates with those of the theaters. This re-estimate indicated that the capacity of the general hospitals in the zone of interior would be insufficient to care for the potential load and, at the same time, provide for zone-of-interior patients customarily treated in general hospitals. The prospective load on general hospitals was reduced, therefore, by providing that all zone-of-interior patients needing the type of treatment afforded by general hospitals would be treated in the new regional hospitals (W.D. Circular No. 140, 11 April 1944), except that patients requiring specialized treatment would continue to be admitted to hospitals designated for specialized treatment. As this step represented only partial relief of the potential pressure on general hospitals, consideration was then given to the conversion of large station hospitals into general hospitals. This was found to be impracticable because of the scarcity of medical specialists.

During this same period, much effort had been devoted to the reconditioning program which aimed to shorten the convalescent period and return soldiers to duty in the best possible physical condition. Analysis of the potential evacuee load by types of patients emphasized that most patients returning from overseas would need long hospitalization, on completion of which many would be released from military service. Many patients would not have to be in bed all of the time; they might need medical supervision part of the time, but they would not necessarily need the care of specialists. However, they would have to be kept occupied with appropriate physical, vocational, and intellectual activities.

Further large-scale construction or reconversion of facilities was precluded, but space had become available in many camps from which troops had been transferred to overseas theaters. The Surgeon General, therefore, planned to meet the overflow load in general hospitals and to provide for the treatment of long-time evacuee cases by the establishment of convalescent hospitals and to date the following have been or are about to be established: Lovell General Hospital, Fort Devens, Massachusetts; England General Hospital, Atlantic City, New Jersey; Fort Story, Virginia; Welch Convalescent Hospital, Daytona Beach, Florida; Wakeman General Hospital, Camp Atterbury, Indiana; Brooke General Hospital, Fort

From the Hospital Division of The Surgeon General's Office.

Sam Houston, Texas; Percy Jones General Hospital, Battle Creek, Michigan; Camp Carson, Colorado Springs, Colorado; and Mitchell Convalescent Hospital, Camp Lockett, California. Later, convalescent hospitals will be opened at Fort Lewis, Washington, and Camp Butner, North Carolina, and possibly in other places. The average size of a convalescent hospital is between two and three thousand spaces. At least one convalescent hospital has been established in each service command.

Convalescent hospitals will provide also for the admission, treatment, and disposition of all mild psychoneurotic cases. The neuropsychiatric section of convalescent hospitals usually will comprise about 700 spaces. All patients, including psychoneurotics, will live in barracks at convalescent hospitals and will wear fatigue clothes. Thus, they will be in an intermediate category—between a hospital patient and a soldier on duty. The neuropsychiatric section will operate substantially independently from the rest of the hospital, although it will be able to utilize the facilities of the hospital.

The program at a convalescent hospital will include: (1) physical reconditioning, calisthenics, remedial exercises, road and track work, and athletics; (2) occupational therapy; (3) educational activities, including orientation and information classes, typewriting, shorthand, and business courses; (4) recreational activities.

Despite this elaborate program, the personnel cost of operating convalescent hospitals will be about 50 percent that of operating general hospitals, and this plan will ensure a much higher utilization of general hospital beds and specialists for the care of bed patients. The average period in a convalescent hospital cannot be estimated at present. Probably, neuropsychiatric patients will remain for thirty to sixty days, and other patients will average ninety days or more.

The convalescent hospital is predicated on an assumption, which can succeed only if specialists facilitate the transfer of patients from general hospitals to convalescent hospitals as soon as they are ambulant and no longer need elaborate hospital facilities or specialists' care.

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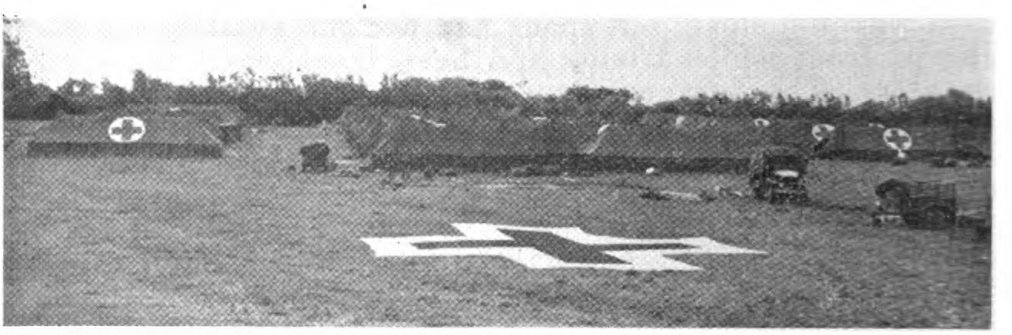

Large red crosses mark ground and tents of a U. S. Army field hospital in France. 12 June 1944. Signal Corps photograph.

## STORAGE QUALITIES OF BIOLOGIC PRODUCTS

Outside cartons for the shipment of biologicals and other miscellaneous items have given various precautions to be followed in shipping. "Keep in a cool place" is a typical example. This precaution is to be followed only while in the hands of the shipper. When the material is received, it should be stored immediately according to the instructions which follow.

Heat, light, and age are the unfavorable factors which determine deterioration of biologic products; the most important of these is heat. Antitoxins and serums, if properly protected from heat and light, will retain their potency for a very long time. Bacterial antigens undergo deterioration very slowly when they are kept refrigerated (45° F.).

It is recommended that all serums be kept in the dark at a uniform temperature, between 2° C. (35.6° F.) and 10° C. (50° F.), preferably the former. Transfers of biologic material from cold to warm temperatures or the reverse should be avoided. Such changes in storage are the cause of more rapid deterioration. The time limit or dating period placed on all biologic products by the manufacturer anticipates protection from light and heat. Failure to comply with this will bring about a situation which may entirely nullify the value of this time limit as an index to the potency of the product.

While it is not probable that any material loss in potency would occur in antiserums from freezing, a precipitate might appear. There is also danger of the container being broken. Care should always be taken to safeguard these products from freezing temperatures during transportation and storage. Unmodified diphtheria toxoid and alum precipitated diphtheria toxoid, tetanus toxoid, and the combined toxoids are stable, but they should not be subjected to either freezing or unduly high temperatures. It has been determined that under ordinary conditions of the market a bacterial antigen might be frozen not more than once or twice. From experimental work with typhoid vaccine on this basis, the conclusion is justified that the deterioration in strength would be negligible.

*Smallpox vaccine must be properly kept in the interval between manufacture and use.* It has been determined that vaccine kept at 140° F. for five minutes is dead; at 132° F. for five minutes, much weakened; at 98° F. for three or four days, dead (this would be the temperature at which the vaccine would be kept if carried in the coat pocket); at 70° F. for one to three weeks, weakened; at 50° F. for three to six months, still alive (refrigerator temperature); and at 10° F. after four years, still alive. An authority states that it is well known that heat seriously interferes with the potency of vaccine virus. A few hours' exposure, even at room temperature, during a summer day, may be enough to render the vaccine virus impotent.

*It is very important that yellow fever vaccine be stored below 0° C. (32° F.) at all times.*

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From the Technical Division of The Surgeon General's Office.

## STORAGE REQUIREMENTS FOR MEDICAL DEPARTMENT ITEMS

I. Biologic products.

A. Antitoxins, antiserums, vaccines, and toxoids.

1584000 to 1739500 inclusive. (Store in dark place between 2° C. (35.6° F.) and 10° C. (50° F.). )

Exceptions.

1608800—Plasma, normal human, dried, 500 cc.

1608900—Plasma, normal human, dried, 250 cc.

(Refrigeration not required. Do not allow to freeze.)

1609000—Smallpox vaccine, 10 tubes.

(Store below 0° C. (32° F.).)

1613000—Yellow fever vaccine, 20-dose (1-cc.) ampule.

1613200—Yellow fever vaccine, 100-dose (5-cc.) ampule.

(Store below 0° C. (32° F.).)

B. Vaccines, autogenous: Therapeutic.

Items 1803000 and 1804000.

(Store in dark place between 2° C. (35.6° F.) and 10° C. (50° F.).)

C. Miscellaneous supplies.

Items 1805000 to 1828000 inclusive.

(Refrigeration not required except for following items.)

1818000—Medium for blood culture, miscellaneous.

1819000—Medium for blood culture for typhoid para-typhoid.

1820000—Medium for bacteriological examination of exudate.

1821000—Loeffler's medium.

(Preserve in dark place at temperature between 2° C. (35.6° F.) and 10° C. (50° F.).)

II. All arsenicals. (Store in cool place preferably at a temperature not exceeding 20° C. (68° F.).)

NOTE: The U.S.P. requirement of 10° C. was a typographical error, since corrected; all arsenicals should be the same—20° C.

III. Miscellaneous items.

1177500—Ergonovine maleate injection, 12 ampules.

1178000—Ergot, 1 cc.

(Store at temperature above 0° C. (32° F.) but preferably not exceeding 12° C. (53.6° F.).)

1232500—Insulin, protamine zinc, 10 cc.

1233000—Insulin, U-20, 10 cc.

1233500—Insulin injection, U-40. 10 cc.

(Preserve at temperature above 0° C. (32° F.) but not exceeding 15° C. (59° F.), avoiding freezing.)

1238000—Iodoform, ¼ lb.

(Avoid excessive heat above 35° C. (95° F.).)

Ointments in a grease base, especially those containing heavy suspended material such as mercury compounds, should be stored at temperatures below 35° C. (95° F.) if possible.

1353000—Pituitary solution, posterior lobe, 6 ampules.

(Store in refrigerator—between 30° F. and 50° F.)

1413500—Sobisminol solution, 100 ampules.

(Avoid storage at temperature above 25° C. (77° F.).)

1472000—Tetrachloroethylene, 100 ampules.

(Store at temperature not exceeding 15° C. (59° F.).)

1489500—Tuberculin, first test strength, 10 doses.

1489600—Tuberculin, second test strength, 10 doses.

(Store in dark place between 2° C. (35.6° F.) and 10° C. (50° F.).)

## ARMY DENTAL CORPS POSTWAR PLANS

The Dental Division of The Surgeon General's Office has received numerous inquiries from dental officers and civilian dentists regarding the probable status of the Army Dental Corps in the postwar period. These questions have been asked: How large will the Regular Dental Corps be? What will be the basis for selection of officers for the Corps? Is there an age limit? Will there be a large standing Army in the overseas theaters? What officers will be relieved from duty first? How and when can one be relieved from duty?

Tentative postwar plans have been made by the War Department to fit various situations pending the extent of the war. However, new international developments, politically and militarily, as well as congressional action will determine the future course of events. A definite plan of action has not yet been consolidated with reference to the important questions cited. It may be stated, however, that the Army Dental Corps will follow the general pattern outlined for the whole Medical Department. All information concerning the postwar plans and activities of the Dental Corps will be released through proper and adequate channels.

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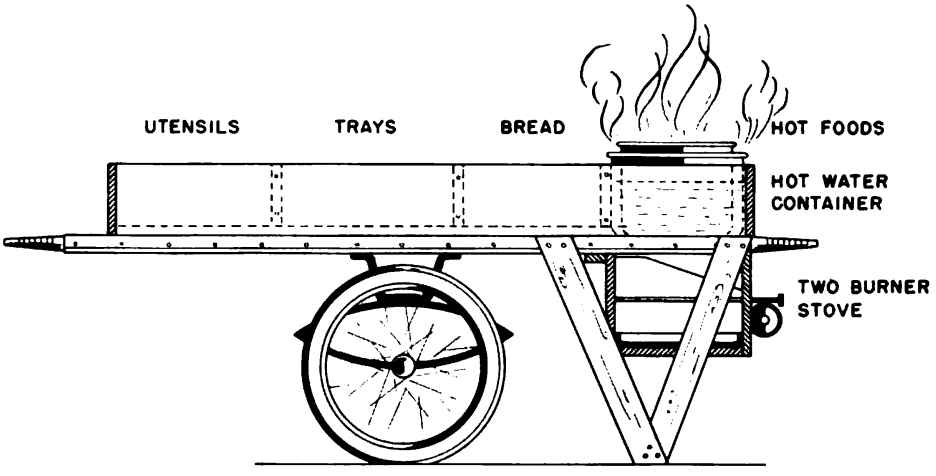
## HOT FOOD CART

A hospital in the Southwest Pacific Area has improvised a cart to keep food warm for patients by building a frame on a wheeled litter. The stove which provides the heat is one of the two-burner Coleman stoves which is standard equipment. The pan over the burner is filled with hot water and the food in the containers from inside the hot food cabinet is placed in




the pan of hot water. A rail is constructed along one side similar to that used in cafeterias. The utensils are stacked on one end and the ward men pick these up and pass down the line receiving the food. The cart will feed about ninety patients.

### POLICY CONCERNING INDUSTRIAL EMPLOYEES

The War Department announced on 10 July a policy concerning the constantly increasing number of female employees in Army industrial establishments in which, at that time, more than 500,000 civilian women were employed and of whom it was estimated more than 60 percent were married. The Office of The Surgeon General has formulated plans, with respect to the employment of pregnant women, which are administered by the medical services in the industrial plants concerned. The Director of Civilian Personnel and Training in the Office of the Secretary of War has set forth personnel policies necesssary to facilitate the carrying out of this program.

The employment of pregnant women at Army-owned and operated installations within the scope of the Army's industrial medical program will be governed by certain rules which are subject to modification by the post surgeon, industrial and medical officer, or family physician when such action would be to the best interest of the employee. These rules are: (1) A pregnant employee should not be continued at work after the thirty-second week of pregnancy. (2) The employee should not return to work until six weeks after delivery, and then only upon approval of her physician. (3) Female employees should report their condition to the industrial medical department when pregnancy is determined in order that they may receive proper supervision and be safeguarded in their work. (4) A pregnant employee should report to the industrial medical department every two weeks, at which time the nature and hours of her work will be ascertained. Any unfavorable symptom will be reported by the post surgeon, industrial medical officer, or plant nurse to the employee's physician. (5) It is inadvisable to employ pregnant women between the hours of 12 midnight and 6 a.m. and for more than forty-eight hours a week. Where possible, two ten-minute rest periods should be arranged during the work shift. (6) Pregnant women will not be assigned to work requiring heavy lifting or strain nor to work which, in the opinion of the industrial medical officer or the employee's family physician, would constitute a hazard to that employee. (7) Provisions for maternity care and leave should not unnecessarily jeopardize the employee's job or her seniority privileges.

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### DISCARDED PROCAINE CARTRIDGES

Discarded procaine hydrochloride cartridges (Med. Dept. Item No. 1383500) are considered to be of practical value for use as connections for rubber tubing in hospitals for the administration of enemas and in laboratories for use as connections for rubber tubing. This suggestion was submitted by Technician Fourth Grade Joseph T. Jones from Ream General Hospital, Palm Beach, Florida.

## INFLUENZA VACCINATION PROGRAM

The Surgeon General has announced plans for the procurement and possible use of a vaccine to combat the spread of influenza, in case an epidemic occurs. The vaccine will not be given routinely, but only on definite indication of the threat of influenza and only to personnel under risk of exposure to the disease. The dose, as stated in War Department Technical Bulletin, TB MED 85, 15 August 1944, will be a single 1-cc. injection given subcutaneously. Repetition of this dose under certain circumstances not as yet clearly defined may be advisable.

The development of protection against influenza has been one of the main projects of the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army since its establishment in 1941, under the presidency of Dr. Francis G. Blake. Under this board, now called the Army Epidemiological Board, the Commission on Influenza was asked in 1943 to carry out a controlled clinical trial of the prophylactic value against epidemic influenza of a concentrated vaccine containing the killed influenza viruses types A and B. In cooperation with civilian and military agencies an investigation was made, particularly during the winter of 1943. On the whole, the results showed a reduction of about 75 percent in the incidence of influenza among the vaccinated as compared with the unvaccinated controls and that the illness in vaccinated persons was milder and shorter.

The vaccine used was developed by Dr. Thomas Francis, Jr., director of the Commission on Influenza, Dr. Jonas E. Salk, and associates. Their studies, preceding the clinical trials, showed that a vaccine composed of influenza viruses A and B inactivated by treatment with formaldehyde definitely protected human volunteers against experimental induction of influenza. Preceding these trials in human volunteers there had been a long series of experiments on animals, showing that the vaccine provided an immunity against influenza which lasted several months.

About 6,000 student volunteers were given the vaccine in the fall of 1943. An equal number of unvaccinated men living in immediate association with the vaccinated were observed as controls. These groups then happened to be naturally exposed to influenza type A which was prevalent in communities where these students were living. The value of the vaccine was made even more striking by the fact that the unvaccinated group of students was made up of roommates of the vaccinated group.

Type A and type B are represented in the virus vaccine because they have been found in outbreaks of influenza in recent years. It is not known whether one or the other, or both of these viruses, caused the pandemic in 1918-1919, as the virus which caused that outbreak was not obtained. Judgment is reserved, therefore, on the question whether the vaccine made from types A and B will protect against the pandemic influenza of the last war.

The vaccine adopted for these purposes in the Army is officially designated as "Influenza Virus Vaccine, Types A and B (Refined and Concentrated)." It contains types A and B viruses recovered and concentrated from equal quantities of extraembryonic fluids from chick embryos infected with virus of the respective types. The type A component consists of equal quantities of the PR8 strain and the Weiss strain. The type B component consists of the Lee strain. These viruses are adsorbed on the red blood cells of the embryo and then removed by elution. By this process the viruses are released into a volume of salt solution to not more than one-tenth of the volume of harvested egg fluid. To render the viruses noninfectious, formaldehyde is added. The material is then subjected to extensive tests according to the standards of acceptability.

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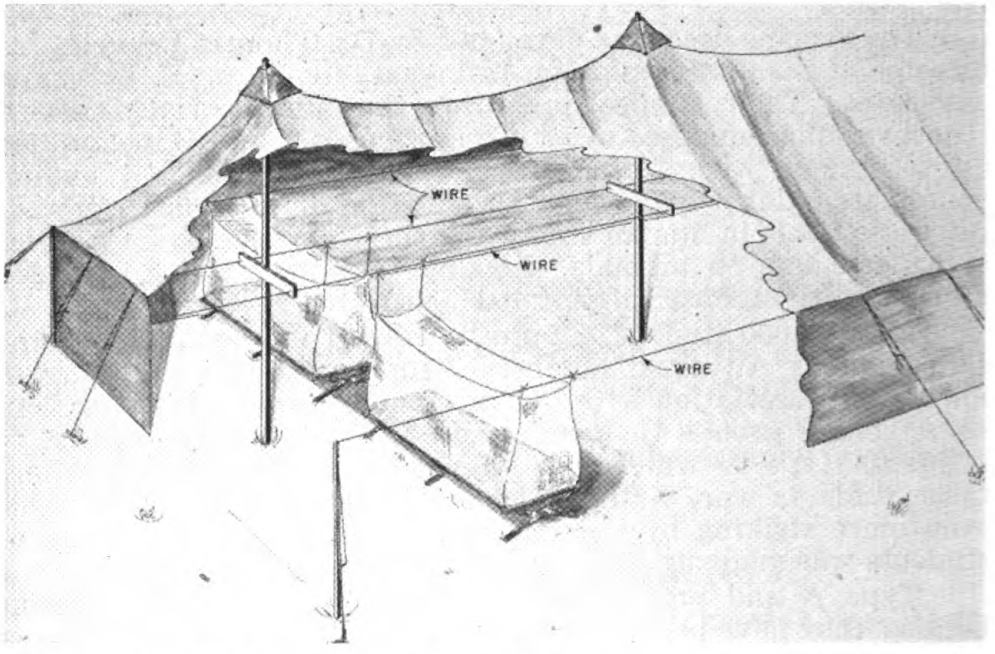
### MOSQUITO BARS

A method of suspending mosquito bars in frame ward tents or in tents as used in more forward areas has been reported by an evacuation hospital in the Southwest Pacific Area. This consists in stretching four wires or heavy cord or rope, if wire is not available, the length of the ward tent at about a 6½-foot level, with wire directly over the head of the




beds on both sides and other wires over the foot of the beds. This evacuation hospital found this method made the mosquito bars more roomy for patients and made nursing care much easier than when the usual mosquito bar holders were used on cots and beds.

### MOSQUITOES IN THE PHILIPPINE ISLANDS

Twenty-nine species of *Anopheles* mosquitoes have been recognized in the Philippines, but on the basis of accumulated evidence only four species can be incriminated in the transmission of malaria. The most active transmitter, *Anopheles minimus flavirostris,* is a stream breeder, definitely preferring clean, fresh, flowing, and slightly shady water with bamboo shoots or roots present. Consequently, malaria is a disease of the foothills and is not seen in the lowlands or rice fields and does not appear above elevations of 2,000 feet. Not until this fact was fully appreciated was any progress made in malaria control. These mosquitoes are more prominent in transitional seasons. Where there are pronounced wet and dry seasons, malaria will appear in two waves each year at the change of the seasons. Where such seasons are not pronounced, malaria is perennial. It has been suggested that the prevalence of malaria in the foothills has been partly responsible for the maintenance of ethnological distinctions between the hill people and those from the plains. Mosquitoes of the *Aedes* group are the common household pest of the Philippines. Two species are found, *Aedes aegypti* and *Aedes albopictus,* both active in the transmission of dengue fever and both effective yellow fever vectors, though this disease is not present. At least one species of *Culex, C. fatigans,* is present and instrumental in the spread of infections with *Wuchereria,* though it is possible that some species of anophelines may also aid in its dissemination.

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### GERMAN PRISONER-OF-WAR HOSPITAL OPENED

A hospital for German prisoners of war, staffed by German doctors, has been opened at Okmulgee, Oklahoma, inaugurating the Medical Department's policy of establishing separate prisoner-of-war hospitals staffed with doctors and medical corpsmen of the prisoners' own nationality. This is in accord with Article 14 of the Geneva Convention of 1929. The German doctors assigned to duty at the hospital have been examined thoroughly, both as to credentials and ability. Properly accredited German sanitary personnel, as well as German prisoners of war, will also be used to provide the enlisted staff for the installation. Only the chiefs of the medical services at this hospital are American Army doctors. Adequate guard facilities are provided as well as the usual stockade fence around the area. Heretofore, prisoner-of-war casualties have been hospitalized in separate sections of various service hospitals throughout the country. The Glennan General Hospital at Okmulgee was selected for conversion to a prisoner-of-war hospital because of the small number of American casualties hospitalized there. These men were removed to other general hospitals.

## DECORATIONS AND AWARDS FOR DENTAL OFFICERS

The following dental officers in the Army of the United States received decorations or awards from 7 December 1941 through 10 July 1944:

| *Name* | *Decoration or award* |
|---|---|
| First Lieut. Ralph P. Baldini | Silver Star |
| First Lieut. Sol A. Berman | Legion of Merit |
| Captain Chester J. Dau | Distinguished Service Star of the Philippines |
| Captain Alfred A. Dolgin | Soldier's Medal |
| Captain Stanley F. Erpf | Legion of Merit |
| Captain David S. Gordon | Legion of Merit |
| First Lieut. Rolland M. Haines | Air Medal, Oak Leaf Cluster |
| Major Raymond J. Hodapp | Legion of Merit |
| Captain John T. Kelly, Jr. | Silver Star |
| Captain Edward J. Kotab | Legion of Merit |
| Captain Robert J. MacLaren | Commendation (for Exceptional Conduct) |
| Captain John S. Martin | Silver Star |
| Captain Paul H. Maurer | Silver Star |
| Captain Arthur H. Nillen | Distinguished Service Star of the Philippines |
| Captain Raymond G. Orsinger | Soldier's Medal |
| Major Joseph H. Weisberger | Oak Leaf Cluster and Distinguished Unit Badge |

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## NEW TRAINING CENTER AT FORT LEWIS, WASHINGTON

An A. S. F. Training Center was established at Fort Lewis, Washington, 29 May 1944, with the medical section under command of Brigadier General James E. Baylis, U. S. A., who previously commanded the Medical Department Training Center at Camp Grant, Illinois.

Basic military training includes rifle marksmanship and related subjects, which is in keeping with the policy of identical training for all Army Service Forces enlisted men during the first six weeks of basic training. After six weeks of basic military training and eight weeks of basic medical technical training, units are formed. After individual training has been completed, the basically trained personnel, technicians, specialists, nurses, dietitians, and officers train together as a unit for six weeks, part of which is spent in the field with all equipment. At the end of this period the unit moves to a hospital for applicatory training.

On 2 June 1944 the Secretary of War designated that the 33d to 42d Medical Training Regiments and the 141st to 170th Medical Training Battalions be activated at Fort Lewis. A short time thereafter, trainer personnel from Camp Grant and Camp Barkeley arrived at the new training center. The facilities available to the Medical Department at Fort Lewis will permit an expansion to 30,000 if necessary. The climate permits uninterrupted training throughout the year, and unlimited areas adja-

cent to the camp are available for field exercises. At present, the center is training individual loss replacements and cadres and fillers for Medical Department units. Medical Department enlisted men are screened and assigned to the battalion which is at the level of training where they best fit.

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### FLYTRAPS MADE FROM EMPTY CARTRIDGE BOXES

Empty 30-caliber cartridge boxes can be converted into effective flytraps with the aid of a saw and hammer, standard mesh wire netting, pieces of wood sawed from the bottom of the cartridge box, and a few nails or tacks.

The directions, modified slightly, reported by Lt. Commander Max Trumper, H-V(S), USNR, are as follows: Unscrew and save all the wing nuts from the lid of the cartridge box; then remove the lid (do not throw it away). Carefully knock out the bottom and saw the wood, with the grain, into the following strips: four (5½ by 1 in.); two (12 by 1 in.); one (9¼ by 1 in.); one (9½ by 5 in.). Now turn the box upside down. Puncture six holes, ¼ in., along the center of the large screen (16¼ by 13 in.) and place it in the box so it forms a V-shaped trough (figure 2). Reinforce the ends of the screen with the four strips of wood (5½ by 1 in.) and nail two strips to each side of the box. Now replace each wing nut and screw down firmly (figure 2).

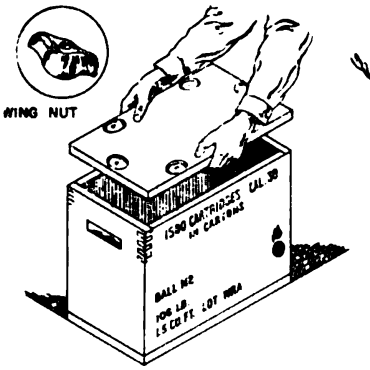

FIG - 1

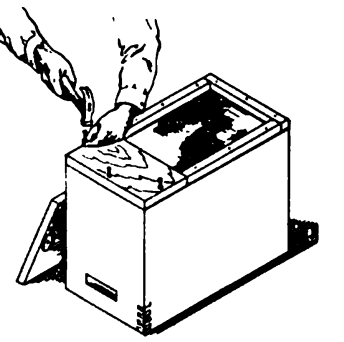
FIG.- 3

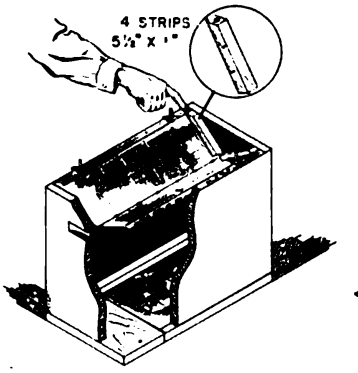

FIG.- 2

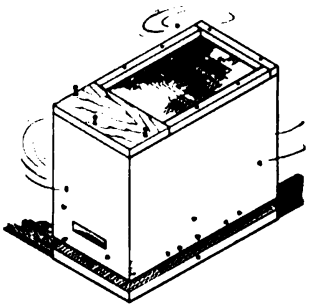
FIG.- 4

Again turn the box over and nail the screen (13 by 9¾ in.) tightly drawn with the aid of the remaining strips of wood. Then place the small door (9½ by 5 in.) in position, driving three nails only halfway to facilitate removal (figure 3).

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Ensign Leo A. Jachowski, H-V(S), USNR, suggested the use of cartridge boxes for flytraps.

D. J. DiFerdinando, PhM3c, V-6, SV, USNR, drew the illustrations. Mr. S. M. DePue constructed the sample traps.

Use the old lid, upside down, as a platform on which to place the converted flytrap. The wing nuts act as feet for the trap and leave an opening of about 1 in. for the flies to enter (figure 4). Place bait (fish heads or any decaying material) on platform in suitable receptacle. Rebait the trap every few days. The trapped flies can be killed by exposing the trap to sunlight or with boiling water. Painting the interior of the trap with Q.M. insecticide, spray, DDT, residual effect, once every few months will eliminate the necessity for other measures.

## RECONDITIONING NOTES

A program to prepare neuropsychiatric patients for return to military duty or to civilian life in the best possible physical and mental condition was announced on 6 August. Those men with psychiatric disturbances will participate in carefully organized convalescent activities under the guidance of psychiatrists. Patients will be permitted sufficient latitude to pursue, as far as possible, interests that will be useful in later Army careers or civilian life. They will wear duty uniforms instead of hospital garb, and they will be under military discipline. The schedules will include physical reconditioning and occupational, educational, and recreational therapy. Any patient who has a remote chance of being salvaged for additional military service will be given a trial in reconditioning.

At least one hospital in each service command will be designated as a neuropsychiatric reconditioning center. Those already selected are named in the article on convalescent hospitals appearing on pages 19 and 20 of this issue.

Patients returning from overseas will be examined and interviewed by psychiatrists at debarkation hospitals. If ward care or individual attention is not required, they will be sent to reconditioning centers. Such patients from station and regional hospitals in this country which have inadequate facilities also will be sent to the neuropsychiatric reconditioning centers.

### News Letter

"Reconditioning News Letter" is a new publication distributed monthly by The Surgeon General to all A. S. F. hospital commanders and service command surgeons. It aims to disseminate widely new ideas, practices, and procedures which might help personnel assigned to duty in the reconditioning program. The sources of the items published are reports made by inspecting officers from The Surgeon General's Office, chiefs of reconditioning branches in the offices of service command surgeons, and medical officers and others having experience with the program.

**Mission of Reconditioning Program**

The mission of the reconditioning program is to accelerate the return to duty of convalescent patients in the highest state of physical and mental efficiency consistent with their capacities and the type of duty to which they are being returned. Should a soldier be disqualified for further military service, the reconditioning program must provide for his return to civilian life, conditioned to the optimum state of physical fitness, well oriented, and indoctrinated in the duties of citizenship. The mission is accomplished by the use of physical reconditioning, educational reconditioning, and occupational therapy.

*Physical reconditioning* is the process aimed at the prevention of physiologic retrogression during convalescence and directed toward the restoration of full strength and stamina through participation in progressively graded physical activities.

*Educational reconditioning* is the process of exciting, stimulating, and activating the mind through education, orientation, and information, thereby encouraging a mental attitude conducive to health and normal activity.

*Occupational therapy* is that form of treatment characterized by assignment to purposeful physical tasks prescribed for restoration of function to injured or diseased muscles, tendons, nerves, and joints, for emotional instability, or prescribed as diversional activity.

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## NEW TUBERCULOSIS CENTER AT SANTA FE

The Bruns General Hospital at Santa Fe, New Mexico, has been designated as a center for the treatment of tuberculosis, with special consideration for oversea cases. When evacuated from overseas because of pulmonary tuberculosis, male officers whose homes are in the Eighth Service Command and all enlisted men of whatever domicile will be sent to this hospital for definitive care pending final disposition. The Bruns General Hospital is located four miles south of Santa Fe, at an altitude of about 7,000 feet. The climatic advantages of the Santa Fe region are well known. The hospital is specially staffed and equipped for the modern treatment of tuberculosis. Brigadier General Larry B. McAfee is in command.

Colonel Earl Harvey Bruns, M. C., in honor of whom the hospital was named, was one of the most distinguished phthisiologists in the history of the Army. Himself a victim of tuberculosis, Colonel Bruns received special training while under treatment at Fort Bayard, New Mexico, and as a member of the staff of the eminent tuberculosis expert, Colonel George E. Bushnell. Colonel Bruns served with distinction in World War I. While chief surgeon of the American Army of Occupation in Germany, he made studies of tuberculosis problems growing out of the war. As chief of medical service at Fitzsimons General Hospital, Denver, which is also an Army tuberculosis center, he introduced much of the therapeutic practice now in effect there and trained many officers in the principles of tuberculosis control.

## DENTAL OFFICER DUTY AND ASSIGNMENT

The mission of the Medical Department is the conservation of manpower and the preservation of the strength of the military forces. The Army Dental Corps is an integral part of the Medical Department and as such it has certain obligations and responsibilities in accomplishing that mission. Although the Dental Corps primarily is concerned with the dental health of the command and the conservation of manpower from a dental point of view, its officers also are a functioning unit in the over-all war plan and must accept, in all instances, the assignments which will be of greatest benefit to the war effort.

Congress first commissioned dental officers by the act of 3 March 1911 and then gave the Dental Corps equal status with the Medical Corps by the act of 6 October 1917. Commissions were granted to the dentists not only because they could fill or extract a tooth, construct a denture, or treat an oral infection, but also because dental officers could be used in the field with troops for a variety of duties. The dental officer may be called on to perform duties other than dentistry and, to be of greatest value to his country, he must learn how the units function with which he must serve. An officer, for example, must drill, hike, and live in the field with the battalion or unit to which he is assigned, so that he may know the methods and mission of that organization. He must learn how best to serve the troops dentally under given conditions and further experience what measure of responsibility he can and must carry as an auxiliary medical officer. It should be very clear to every dental officer that dentists would not have been commissioned if *all* that is expected or anticipated of them is professional dental service in a hospital. The dental service in a hospital or fixed installation could be accomplished by contract dentists; however, dentists have been commissioned, they have been afforded the privilege of fitting into the military organization, and they have been delegated to many responsible positions. The fact that a man has a D.D.S. degree does not entitle him to a commission. A commission signifies far more than one's ability to render effective dental service, and Congress, with the approval of the War Department, has provided the right to commission the dentist with the expectation that the man with the D.D.S. will fit into the military organization, that he will be loyal to his country and to his profession, and that he will obey orders and serve in any capacity to which he is assigned. A few officers are willing to wear the uniform and accept the privileges of a commission in the Army of the United States but are not willing to assume all the responsibilities incident to the problems at hand.

There will always be a battalion dental surgeon as long as the battalion is part of the military organizational plan,

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From the Dental Division of The Surgeon General's Office.

and there will always be loyal dental officers who will be glad and willing to sacrifice their future, as well as their lives, to be of greatest possible assistance to the troops and their country. Some dental officers achieved the field grades because of their military knowledge and their position in the division or in the Army. Not all dental officers can be promoted to field grades, but all officers can respect and honor the commission which they possess. An officer who shows disinterest in his duty or assignment, whatever it may be, and who is not willing to experience the hardships of the troops, does not deserve the privilege of wearing the uniform.

A *few* dental officers write members of Congress or men of standing in the dental profession, asking that something be done to relieve them of a particular assignment or complaining because they have not been promoted. Apparently, some of these officers are more concerned with promotion and personal comfort than with rendering a just service to their fellow man. There are many engineers, lawyers, physicians, and others who are rendering a very valuable service to their country but are not delegated to duties of their liking, choice, or within their specialty. It is indeed gratifying that all but a few dental officers are willing to adapt themselves to the situation at hand and are constantly striving to be worthy of their commissions as well as to share in the responsibility of keeping their country free. This war could not be won if the enlisted men and the majority of officers in all branches of the service saw fit to place self-interest and self-expression above all. That the Army Dental Corps as a whole has rendered an outstanding service to the nation in the rehabilitation of more than a million men and is daily performing with honor in every field of battle need not be reviewed here. It is hoped that when the war is over, every dental officer can feel that he has made a contribution to the final victory, and that he can justly say to himself, to his family, and to his fellow man, "I have performed *all* duties assigned to me to the best of my ability; I have not placed self-interest and gain above the call of duty; I am a real American."

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### NURSES, PHYSICAL THERAPISTS, AND DIETITIANS

Temporary appointment as officers in the Army of the United States was authorized in Public Law 350, 78th Congress, approved 22 June 1944, for members of the Army Nurse Corps and female dietetic and physical therapy personnel of the Medical Department of the Army, exclusive of students and apprentices. All such personnel on active duty on 22 June 1944 were commissioned in grades held by them on that date, by Executive Order No. 9454, issued 10 July 1944. In commissioning physical therapy personnel, the term "Physical Therapy Aide," was discontinued and the title "Physical Therapist" employed.

## REPAIR OF SPECTACLES AT THE FRONT

Among the first medical supplies landed on the Normandy beachheads on D-day was the portable optical repair unit (Med. Dept. Item No. 9363900).

Captain A. T. Wells, Sn. C., writes that prior to the spring of 1944 spectacle replacements and repairs overseas were handled by optical repair units, 2½ ton, 6 x 6 trucks, located at medical supply depots. Requisitions were sent in by mail or messenger and, after days of waiting, the soldier who had lost or broken his glasses received another pair. The need for an optical unit that would immediately service the soldier at his battle station was obvious.

The Army Medical Purchasing Office anticipated the need for a small unit which could be transported by plane or jeep to the farthest outposts and forward battle fronts, a unit necessarily portable, yet containing spectacle frames and lenses of several hundred curves or foci and machinery capable of operation without electric power to cut and fit the lenses to metal frames.

A complete design with drawings and description of every component together with an original lens grinder operated by hand was presented in January 1943.

Experimenting with two standard medical field chests, it was demonstrated that, when they were turned on end, the inside could be equipped with shallow drawers and hinged doors like a wardrobe trunk. The two chests, strapped together, made a workbench; the machinery could be fastened to the top and technicians could select lenses from marked slots, cut and grind them, and with pliers fit the glasses to the wearer. The gross weight of the two chests in the unit was controlled at 400 pounds.

The following equipment was packed in each unit: 2,400 assorted lenses, 2-inch diameter; 625 metal spectacle frames, G.I.; 150 pairs gas mask inserts, metal rings to hold focused lenses in gas masks; 1 precision cutter; 1 grinder to fit lenses to spectacle rims; 1 case of tools to assemble, fit, and repair spectacle frames; 1 test set for testing lenses or vision; miscellaneous spare parts, screws, nose pads, ear pieces, etc.

The principles followed were so elementary that wearers of spectacles in a force of 5,000 to 15,000 men could be serviced by two optical technicians. An original technique involved the use of "fit-over" spectacle fronts for emergencies. If a No. 6 lens, for example, were needed and all No. 6's had already been dispensed, a combination of No. 4 and No. 2, or two No. 3, lenses would restore vision. The "fit-over" fastens to the front of the spectacle and holds the extra pair of lenses. A unique device provided a primary vision test consisting of a pair of folding test charts, an arrangement to hold test lenses before the eyes, and a manual of instructions. The design for the portable optical repair unit was executed and the unit presented to a subcommittee in The Surgeon Gener-

al's Office on 8 February 1944. The item was accepted and the pilot model was submitted to the Medical Equipment Laboratory at Carlisle Barracks, Pennsylvania, where it passed Medical Department field requirements. Specifications then were written and one hundred of these units purchased, delivery commencing in December 1943. Now soldiers throughout theaters of operations may continue at their posts, unimpaired by the discomfort of faulty vision.

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## PLASMODIUM OVALE IN NEW GUINEA

*Plasmodium ovale* malaria contracted in New Guinea has been reported by Major A. V. Jackson of the Medical Department of the Australian Army. The two Australian soldiers in whom the infections were discovered had not been exposed to malaria before going to New Guinea where the diagnoses were made. Blood films were examined by Brigadier N. H. Fairley, director of medicine, A.I.F., and Lieut. Colonel I. M. Mackerras, who confirmed the identification of the parasites. These are the first cases of ovale malaria reported from New Guinea.

The infections were mild and responded to one course of combined quinine-atabrine-plasmochin therapy. In one patient hospitalized on 1 July 1943 for mild fever, the diagnosis of malaria was made from a thick drop preparation. Ten grains of quinine were given but, when a study of the thin smear suggested forms of *P. ovale*, the medication was stopped. Clinical symptoms and parasites disappeared until 13 July when fever and parasitemia recurred. Although no specific medication was given, the clinical course was mild and by 22 July the symptoms had ceased and few parasites were found in blood films. A course of quinine-atabrine-plasmochin was given and no relapse had occurred by June 1944.

The second patient was hospitalized on 30 December 1943 with headache, pain in extremities, and chilliness. Parasites of *P. ovale* were demonstrated in blood films and treatment with quinine-atabrine-plasmochin was started immediately. By 2 January 1944 symptoms and parasitemia had disappeared and had not returned at the end of a six-months period of observation.

Stephens in 1922 gave the name of *Plasmodium ovale* to what he considered a new human malaria parasite found in the blood of a soldier from East Africa. Craig believed it to be the same parasite which he had described in 1900 in the blood of a soldier returned from the Philippine Islands. After reviewing the literature, in 1939 Sinton, Hutton, and Shute considered the distribution of the parasite to be confined almost entirely to tropical Africa; however, cases have been reported also from Southern Rhodesia, Eastern Russia, Persia, and South America. James and his co-workers succeeded in transmitting the infection through *Anopheles maculipennis*.

From the Tropical Disease Control Division of the Preventive Medicine Service of The Surgeon General's Office.

Morphology of the parasites conformed with the descriptions by Stephens and James. In thick film preparations *Plasmodium ovale* was easily confused with either *Plasmodium vivax* or *Plasmodium malariae*. In thin smears the ring forms resembled the rings of the other plasmodia. The ameboid forms were smaller, more regular in shape, and less motile that *Plasmodium vivax* parasites and were more like *P. malariae*. The pigment was granular and brown-black, similar to that of *P. malariae*. The mature schizonts were smaller than red cells and contained about eight merozoites, never more than twelve. Gametocytes were small, never filling the red cell. The infected red cells were from normal to slightly larger than normal in size and about one-half of them were oval or pyriform in shape. Almost all infected cells showed Schüffner's dots and many of those of pyriform shape were fimbriated along the flat margin.

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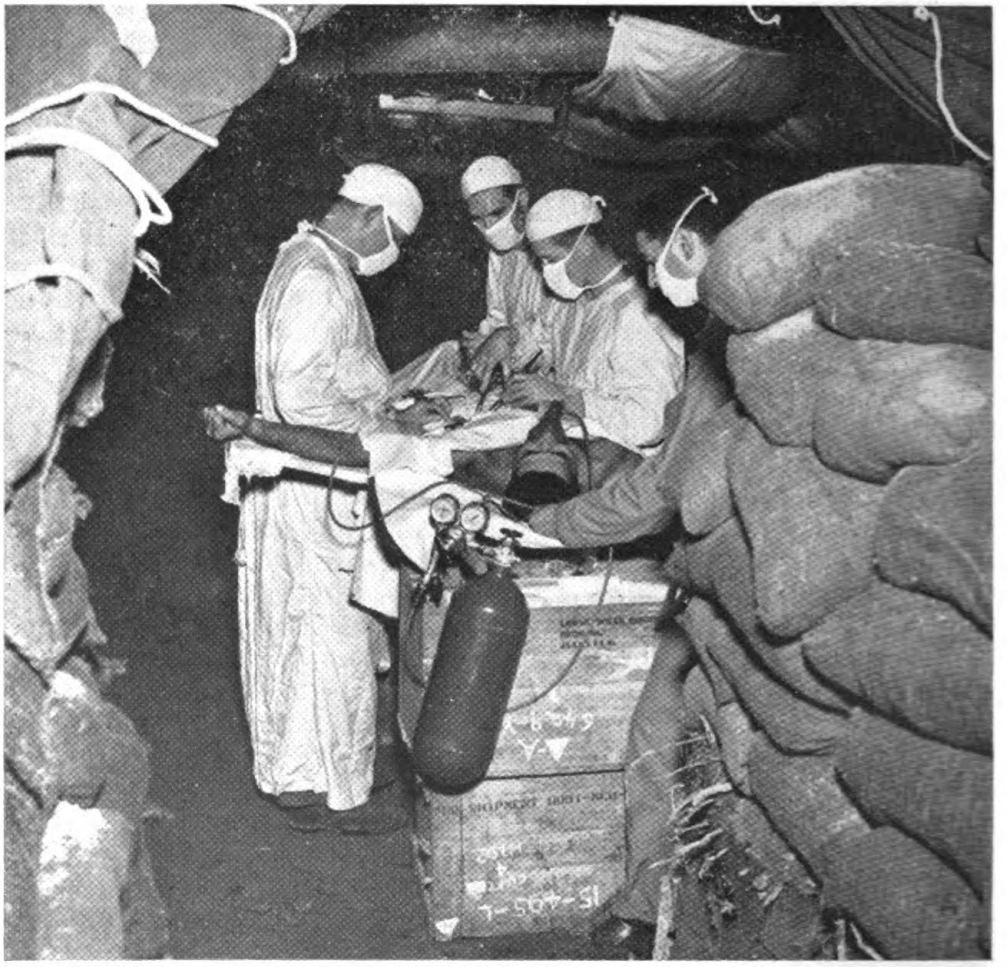

Emergency operation in a dugout in the jungle of Bougainville Island in the South Pacific. The sides are built up with sandbags. Roofed with logs, the entire structure is covered with a pyramidal tent. This group forms a combat surgical team. 30 November 1943. Signal Corps photograph.

## COMPARISON OF CASE FATALITY RATES

The progress in medical science resulting from greater knowledge in combating disease is vividly illustrated by comparing case fatality rates in World War I and World War II. From 1 April 1917 through 31 December 1919, of every 100 deaths from disease in the Army, somewhat more than 40 were caused by influenza and about 33 by pneumonia. While influenza attacked a large number of individuals, it killed only about 3 out of each 100 patients unless complicated by pneumonia. The case fatality rate of pneumonia was nearly 25 in each 100 cases. The use of sulfonamides has decreased the case fatality rate for pneumonia (reported as other than atypical pneumonia) to 0.7 per 100 in 1942 and about the same in 1943. It is possible, however, that an unknown proportion of the cases so reported were, in fact, atypical pneumonia, and this would have the effect of depressing the true case fatality rate for bacterial pneumonia. For atypical pneumonia, the case fatality rates were approximately 0.2 per 100 in 1942 and 0.1 per 100 in 1943.

About 4 percent of the deaths in the Army in World War I were attributed to measles. The incidence of measles was very high (23.8 per 1,000) and a large proportion of the cases were accompanied by serious complications, chiefly pneumonia. As a result, the case fatality rate was about 2.4 per 100. In the present war, the admission rate from measles has been only about one-fifth of that in World War I and the fatality rate has been negligible, thanks to fewer secondary infections and better control over them. The case fatality rate of scarlet fever has been reduced from about 3 per 100 to less than 0.3 per 100, although the incidence of scarlet fever has been higher in recent years than twenty-five years ago.

Meningococcal meningitis accounted for over 3 percent of the deaths in World War I and had a case fatality rate of 38 per 100. Through the use of sulfa drugs, the case fatality rate has been reduced to 7.4 per 100 in 1942 and 4.3 per 100 in 1943.

While dysentery was not an important cause of death in World War I, it is estimated that about 1½ percent of the patients admitted for this condition died. Even with a higher incidence of dysentery in World War II due to deployment of our forces in tropical and semitropical areas, the case fatality rate has been negligible. In this instance, the favorable results can be partly attributed to sulfaguanidine and sulfadiazine.

Epitomizing these achievements is the fact that the mortality of the Army from disease during 1942 and 1943 has been at the extremely low rate of 0.6 per 1,000, or only about one-third the death rate of civilians of like age and color distribution and only about 15 percent of the mortality rate of the Army in World War I, even after excluding the deaths attributable to the influenza epidemic.

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From the Statistical Analysis Branch, Medical Statistics Division, Office of The Surgeon General.

## RECENT DIRECTIVES AND PUBLICATIONS

**This list is intended as only a brief reference to the items mentioned. Before acting on any of them, the original communication should be read and request for copies, when made, should be directed to the source of the communication through proper channels.**

| | |
|---|---|
| WD Circular No. 237<br>12 June 44<br>Sect. VIII | Neurotropic Virus Diseases. Effective immediately, specimens of blood and spinal fluid for virus identification to be forwarded by air express to Virus Laboratory, Army Medical School, Washington. D. C. |
| AR 40-590<br>12 June 44<br>C 20 | Hospitals. Provides that members of Enlisted Reserve Corps, not on active duty, who suffer injury or disease while undergoing training as A.S.T.P. students, may be admitted to Army hospitals. |
| AR 605-115<br>17 June 44 | Sets forth revised regulations re leaves of absence and delays of commissioned officers. |
| ASF, Headquarters<br>Circular No. 186<br>20 June 44<br>Part Two, Sect. IV | Civilian Personnel. Authorizes chiefs of technical services and others to confer awards for meritorious service without review of higher echelons. |
| WD Circular No. 254<br>21 June 44<br>Sect. III | Health. Requires that troops be taught health precautions and sanitary measures necessary to protect them against special diseases common to certain oversea theaters. Lists W.D. pamphlets available as instructional material on geographic distribution of diseases. |
| ASF, Headquarters<br>Circular No. 189<br>22 June 44<br>Part Two, Sect. V | Occupational Therapy. Authorizes program of training for civilian occupational therapy aides for general hospitals. S.G. to exercise staff supervision over program, and to select and assign certain trainees to general hospitals. Makes provisions re qualifications of students and courses of instruction to be pursued. Lists schools which will give instruction. |
| WD Circular No. 272<br>3 July 44<br>Sect. VII | Hospitals Records. When hospital is closed, C.O. to eliminate nonrecord materials as provided in par. 3b, AR 345-10. Retained clinical records. exposed x-ray films, and other hospital records to be disposed of in accordance with procedure specified. |
| ASF, Headquarters<br>Circular No. 208,<br>6 July 44<br>Part Two, Sect. III | Consultation Service. To be established at A.S.F. training centers not having such service available in accordance with the plan set forth. Service to be operated by neuropsychiatrists and is intended to assist normal individuals who have correctible maladjustments in adjusting to Army service. |
| WD Circular No. 281<br>6 July 44<br>Sect. VIII | Physical Therapy. To achieve closer coordination of physical therapy activities with those of orthopedic sections, directs that physical therapy departments be made a part of the orthopedic sections in hospitals, unless such transfer would prejudice care of patients because of local conditions. |
| WD Circular No. 295<br>13 July 44<br>Sect. I | Provides that: (1) collection of ward service charges from dependents of military personnel is to be discontinued at once; (2) employment of attendants for care of all patients whose admission is authorized from appropriated funds, and only in emergencies will such persons be paid from post hospital funds. |

Additional references appear on pages 87 and 92.

## AWARDS

The War Department has announced the following awards to Medical Department personnel:

### Legion of Merit

COLONEL JOHN A. ROGERS, M. C., of Washington, D. C., for exceptionally meritorious conduct in the performance of outstanding services from 20 October 1943 to 31 May 1944 in the European Theater of Operations.

LIEUT. COLONEL STEPHEN L. GUMPORT, M. C., of New York, N. Y., for exceptionally meritorious conduct in the performance of outstanding services from 25 January 1942 to 28 January 1943.

MAJOR JOHN L. DEVINE, JR., M. C., of Minot, North Dakota, for exceptionally meritorious conduct in the performance of outstanding service from 23 September 1943 to 15 March 1944.

### Silver Star

LIEUT. COLONEL WILLIAM J. SHAW, M. C., Fayette, Missouri: For gallantry in action at Humboldt Bay, Dutch New Guinea, 23 to 24 April 1944.

CAPTAIN JOSEPH J. NANNARIELLO, M. C., White Plains, New York: For gallantry in action at Humboldt Bay, Dutch New Guinea, 28 April 1944.

CAPTAIN PETER C. GRAFFAGNINO, M. C., of New Orleans, Louisiana: During the period from 15 to 23 February 1944 in Italy he was in charge of an infantry battalion aid station and was the sole medical officer present at the time. The area of the aid station was under enemy mortar and artillery fire and was subject to enemy bombing attacks. He cared for and evacuated 104 wounded men without the loss of a life. He spent much time with front-line companies giving encouragement and medical attention to the wounded. When the battalion was ordered to a new position and it was impossible to evacuate several wounded men, he remained with the wounded to care for them. (Reported a prisoner of war)

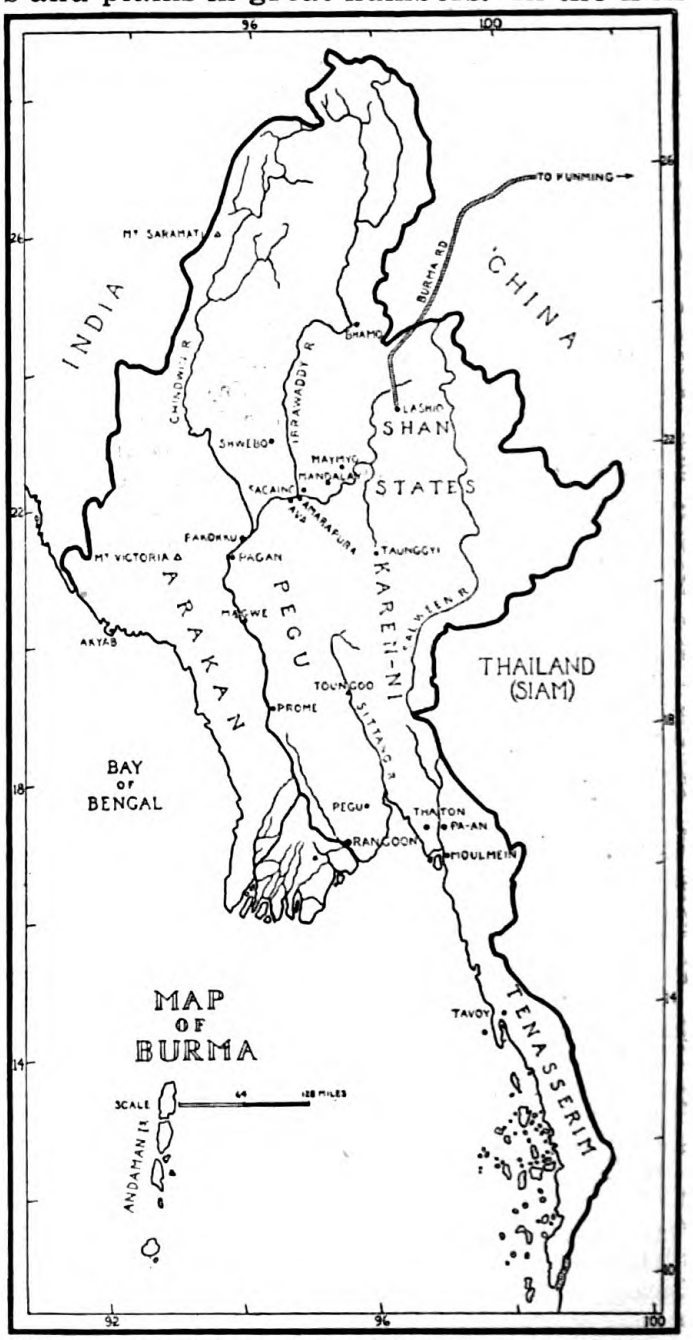
CAPTAIN DAVID L. BEAVERS, M. C., of Apex, North Carolina: On 12 December 1943 in the Mediterranean Theater, he was assistant battalion surgeon in charge of an infantry aid station. The enemy shelled the crest and slope of a mountain, on which the troops were established, for two and one-half hours. Casualties occurred at such a rapid rate that normal evacuation methods proved to be inadequate. He left a technician in charge of the aid station and went forward to move about among the wounded on the crest of the mountain constantly under fire. He treated many men on the scene, undoubtedly saving lives of seriously wounded men who required immediate medical attention.

CAPTAIN RALPH S. PHELAN, M. C., of Waurika, Oklahoma: On 22 November 1943 in the Mediterranean Theater he was battalion surgeon of an infantry battalion which was occupying a defensive position on a mountaintop. Enemy artillery caused many casualties and the rugged terrain made evacuation almost impossible. He went up the side of the mountain and administered first aid to the wounded in the battle area. His action under fire was credited with saving many lives.

SERGEANT ARVEL O. THREADWELL, Medical Department, Deming, New Mexico: Near Rossun Village, Manus Island, Admiralty Group, 20 March 1944, on being informed that a wounded soldier was lying helpless and under enemy fire in advance of our front lines, and completely disregarding the intense enemy fire, he proceeded to the wounded man, administered first aid, and secured his removal to safety. His disregard for his own personal safety in his gallant determination to help a fallen comrade indicates his high sense of devotion to duty and is worthy of the highest ideals and traditions of the Medical Department.

## FOOD IN THE BURMA JUNGLES

The jungles of Burma offer a great variety of foodstuff—fish, fruits, vegetables, roots, bulbs, wild honey, game birds, and meat from wild animals. Food may be obtained at any time of the year. In the fall when acorns and chestnuts are ripe, wild pigs gather in the valleys and plains in great numbers. In the hills when the rice is ready to cut, they visit the fields at night and can be easily shot. If any pigs are about, there will be fresh wallows and mud on the bushes nearby. In the heat of the day, it is wise to wait quietly for them near a large tree. On hearing the sound made by hitting two rocks together to resemble the rubbing of tusks, the boars will come with a rush, prepared to fight a rival. The pig is one of the swiftest and most dangerous of wild animals. When encountered on a path or a hillside, it is best not to shoot, as he will make a sudden charge and it is almost impossible to get out of his way. The young pigs, which are the best eating, are not dangerous. If there are fresh signs of rooting, it is usually certain that wild pigs are nearby, and, in the morning or evening, they




Map of Burma. **Reduced one-fifth in width from** scale indicated. **Published through the courtesy of** the Smithsonian **Institution.**

Extract from special report, Office of War Information.

will be found moving about. A large herd can be heard for some distance. They are great fighters and, in such herds, they are bold.

Barking deer, one of the best game animals, are found everywhere and can be decoyed by blowing on a leaf to imitate the fawn. They bark like a dog and continue to do so for some time but, if alarmed, give a few quick barks, then run a long distance and remain alert. They can be observed grazing and at the sulfur springs.

The serow is so inquisitive that it stops and looks at every sound. This large animal is good to eat. They have a sharp, bark-like call which can be heard at night when they are alarmed. The serow never visits the sulfur springs. Once a trail is found they can be easily tracked. When the grass is dry, the natives set it afire, and the serow will come out ahead of the flames.

The porcupine is the best food animal of the jungles and one of the easiest to obtain. It uses beaten trails which lead for miles from its hole. The best way to shoot these animals is to wait along the trails with a torch at which they will stare. The large ones weigh as much as a barking deer. They are very crafty and have a remarkable sense of smell. When waiting on the trails one dares not walk on the path, as they will come within a few feet of the human scent and dart back. The best time to hunt is during the dark of the moon.

The tree civet is like the raccoon and lives entirely on fruit. They can be decoyed by making a sucking noise on the palm of the hand. When a torch is used, they will stare at the light. A banyan tree in full fruit is the most certain place to find them. From about nine at night until nearly dawn, they will be found eating the fruit. If one flashes a light around the lower branches at night, he is almost certain to find a pair of bright eyes.

The black tree squirrel, which is about the size of a large hare, has a tail about 2 feet long. It may be seen jumping about in high trees and can be attracted by the noise made by sucking on the hand. It will chatter and thrash its tail from side to side, giving time to shoot. During the day they lie out on a limb with the tail hanging down. The black squirrel feeds on fruits and is usually found in banyan trees.

The flying squirrel is never seen in the daytime, as it lives in holes and not in nests like other squirrels. It is decoyed by the same method as the palm civets. It will stare at a torch for a long time without moving. These animals make a terrifying noise which may be mistaken for that of a leopard. The bark around the hole where they live is usually gnawed; by beating on the tree trunk, one can get them out in the daytime. They will sail to a nearby tree and hide, but their long tail gives them away.

Hares are found only in the plains. The natives make a screen behind a light at night to conceal themselves. They rattle some small stones and the hares hop along toward the light. The best way is to walk along beating the bushes.

# Correspondence

## AMAZING RESULTS IN NEW GUINEA

Abstract of a letter from the Envoy Extraordinary and Minister Plenipotentiary to Australia to Major General Norman T. Kirk, The Surgeon General.

**American Legation,**
**Canberra, Australia,**
**7 June 1944.**

**Dear General Kirk:**

**I have just returned from a trip to New Guinea where I visited all of the areas in eastern New Guinea where American forces are established and working, except for the combat areas. The work which our Army medical services have done in the New Guinea area is so remarkable and so amazingly successful that I felt that I must sit down to write and tell you this.**

**Certainly New Guinea is an impossible area for a white man to live and work in, but I did not see or hear a mosquito the whole time I was there, and the records of the various commands and the hospitals show that through the efficiency of the control, planned and carried out in all of these areas, amazing things have been accomplished so that malaria is no longer a threat to the success of our mission in this area of war.**

**I wish I could mention by name all of the officers and men connected with this service whom I met and saw working, because it is a tribute to each and every one of these men, from the highest to the lowest, that such amazing things have been accomplished in so short a time.**

**With kindest regards, I am**

**Sincerely yours,**

**Nelson Trusler Johnson**

# Special Articles

# Penicillin

## 1. Prolonged Action in Beeswax-Peanut Oil Mixture
## 2. Single Injection Treatment of Gonorrhea

CAPTAIN MONROE J. ROMANSKY
Medical Corps, Army of the United States
and
TECHNICIAN FOURTH GRADE GEORGE E. RITTMAN
Medical Department, Army of the United States

The clinical effectiveness of penicillin has been well established. However, to date, a completely satisfactory method of administering penicillin has not been found. The present methods of administration have acted, in a sense, as a barrier in determining the optimum dose and the period of time necessary for treatment; in addition these methods involve inconvenience to the patient and to the personnel administering the penicillin.[1 2 3 4 5]

The intramuscular route, which has been used most commonly, results in high blood levels of penicillin enduring for brief periods of time and necessitates frequent injections. The intermittent intravenous method also results in transitory high levels and necessitates repeated venipunctures. The constant intravenous procedure, although maintaining a satisfactory level, is difficult on the patient and involves the possibility of thromboses. The constant subcutaneous infusion,[3] the drip infusion into bone marrow,[4] and the continuous intramuscular drip infusion,[4] all are inconvenient to the patient and require further trial.

A method of administration of penicillin which would decrease the rate of absorption and prolong the duration of an effective level in the blood, in addition to being of minimum inconvenience to the patient, would be of much importance.

From the Penicillin Section, Laboratory Service, Walter Reed General Hospital.

Sixty-five additional cases of gonococcic urethritis have been treated since this paper was written. The only failure in the entire group was the first case reported above. The data on these cases will be reported later with Captain Robert J. Murphy.

Miss Dorothy Talbot and Technician Fourth Grade Minna Levy rendered valuable technical assistance.

1. Dawson, M. H., and Hobby, G. L.: The Clinical Use of Penicillin; Observations in 100 Cases, J. A. M. A., 124:611-622, 4 March 1944.
2. Herrell, W. E.: The Clinical Use of Penicillin; an Antibacterial Agent of Biologic Origin, J. A. M. A., 124:622-627, 4 March 1944.
3. Bloomfield, A. L., Rantz, L. A., and Kirby, W. M. M.: The Clinical Use of Penicillin, J. A. M. A., 124:627-633, 4 March 1944.
4. Morgan, H. V., Christie, R. V., and Roxburgh, I. A.: Experiences in the Systemic Administration of Penicillin, Brit. M. J., pp. 515-516, 15 April 1944.
5. Unpublished data on observation of 250 cases treated with penicillin at Walter Reed General Hospital.

Prolonged action of histamine,[6] desoxycorticosterone acetate,[7] and heparin[8] can be obtained by placing them in a mixture containing beeswax.

In the present study the beeswax has been utilized to decrease the absorption rate of penicillin and maintain a constant effective level in the blood for a longer period of time than that obtained with penicillin in physiologic saline. Prior to the utilization of beeswax, in February 1944, we had suspended penicillin in refined peanut oil, sesame oil, cottonseed oil, corn oil, castor oil, olive oil, and protamine zinc in an attempt to produce prolonged action in rabbits after intramuscular injections. This resulted in more enduring levels than occur with penicillin in physiologic saline but it was felt that a greater prolongation was desirable.

After preliminary trials with varying amounts of U.S.P. bleached beeswax in the different oils, the most satisfactory results in these pilot experiments were obtained with a beeswax-peanut oil mixture. Because calcium penicillin is less hydroscopic than the sodium salt and also forms better mixtures with the oils, it was used for the majority of the experiments.

The pipettes, syringes, needles, beeswax, and peanut oil were sterilized by autoclaving at 17 pounds of steam pressure for twenty minutes. Before sterilization, the beeswax had been heated to a liquid state and filtered through six layers of gauze and the peanut oil had been filtered through a Seitz filter. Under sterile conditions, 0.75 percent, 1.0 percent, 1.25 percent, 2.0 percent, 3.0 percent, 4.0 percent, 5.0 percent, and 6.0 percent mixtures of beeswax in peanut oil were prepared in the following manner: The sterile beeswax was heated until it became clear and liquid and the desired amount was added by means of a warm pipette to the sterile peanut oil which had been brought to about 37° C. This mixture was shaken well and left at room temperature. An ampule* of calcium pencillin was shaken by hand to break the penicillin into as powdery a state as possible. The contents of the ampule were then placed in a warm (37° to 40° C.), dry, sterile bottle and 2 to 3 cc. of the clear, warmed beeswax-peanut oil mixture was added with a warm pipette, the mixture being allowed to drip down the inside walls of the bottle. Three to five sterile glass beads were then placed in the bottle. The bottle was stoppered with a sterile rubber stopper and shaken by hand for ten to fifteen minutes until the particles of penicillin were well dispersed.

6. Code, C. F., and Varco, R. L.: Prolonged Action of Histamine, Am. J. Physiol., 137:225-233, Aug. 1942.

7. Code, C. F., Gregory, R. A., Lewis, R. E., and Kottke, F. J.: Prolonged Action of Desoxycorticosterone Acetate, Am. J. Physiol., 133:P240-241, June 1941.

8. Bryson, J. C., and Code, C. F.: Prolonged Anticoagulant Action of Heparin in a Beeswax Mixture, Proc. of Staff Meeting, Mayo Clinic, 19:100-108, 23 Feb. 1944.

*The ampules of calcium penicillin which were used practically throughout these studies assayed 83,000 instead of 100,000 Oxford units per ampule. If sterile stoppered bottles containing penicillin are available, the contents of several bottles may be added to one and the oils added in necessary quantities.

Following the above procedure the penicillin is distributed throughout the mixture, which is sufficiently liquid to be injected with a 20-gage needle. It can be used at once or, if stored in the refrigerator, should be brought to room temperature and reshaken before injection. Aerobic and anaerobic sterility tests have shown no evidence of contamination. The factor limiting the amount of penicillin which can be dispersed in a given volume of beeswax-peanut oil mixture is the

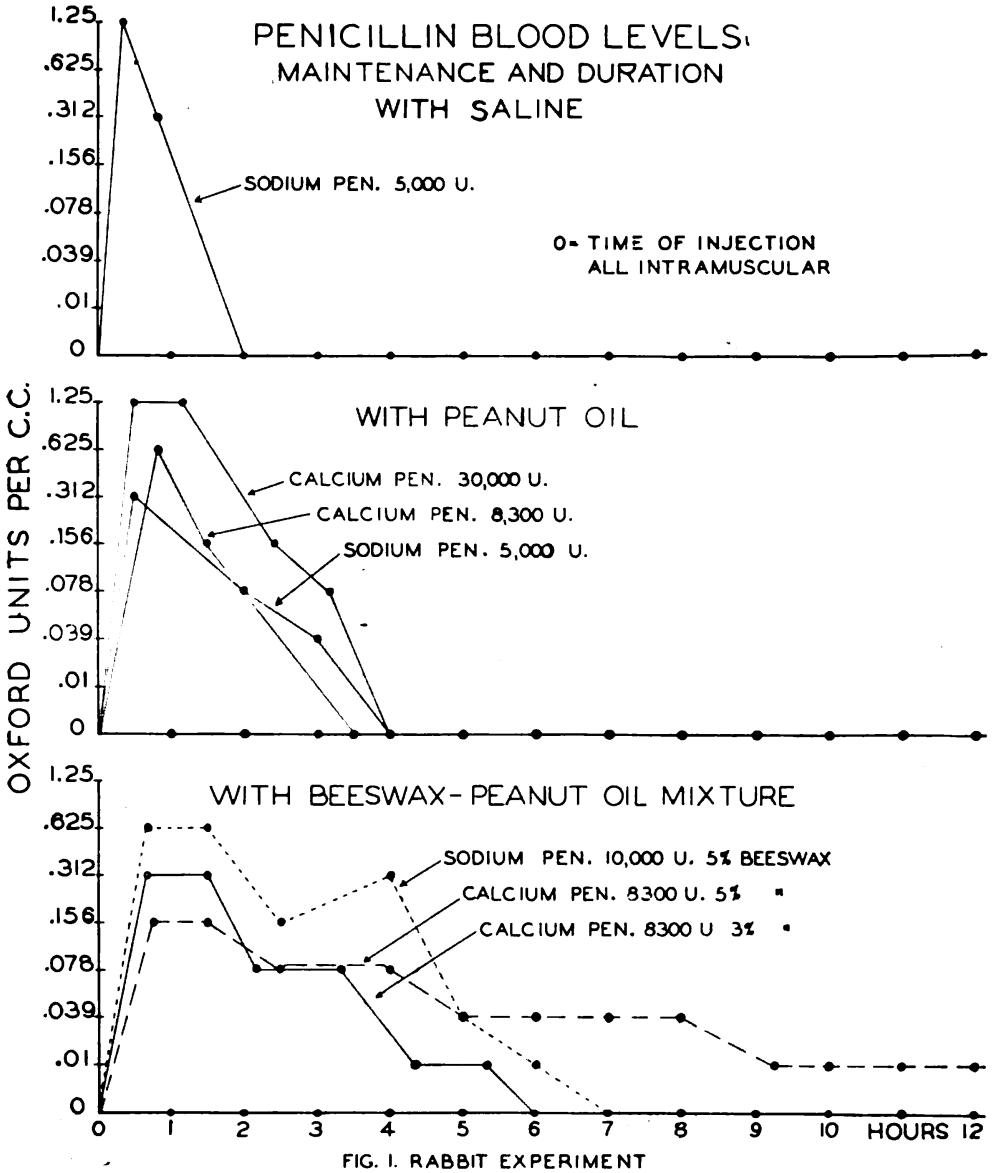



FIG. I. RABBIT EXPERIMENT

weight of the penicillin. This is demonstrated by the fact that different brands of penicillin may vary between 300 and 1,000 Oxford units per milligram. Therefore, the greater the potency of a brand of penicillin in terms of Oxford units per milligram, the greater will be the number of units that one can contain in a given volume of beeswax-peanut oil mixture.

Stability tests* on the penicillin in oil and in beeswax-peanut oil mixture show no deterioration in various batches kept at refrigerator, room, and 37° C. temperatures for thirty to sixty-two days. These stability determinations are being continued. Peanut oil and beeswax-peanut oil mixture, *per se*, show no antibacterial action when tested in the same manner as the penicillin beeswax-peanut oil mixture.

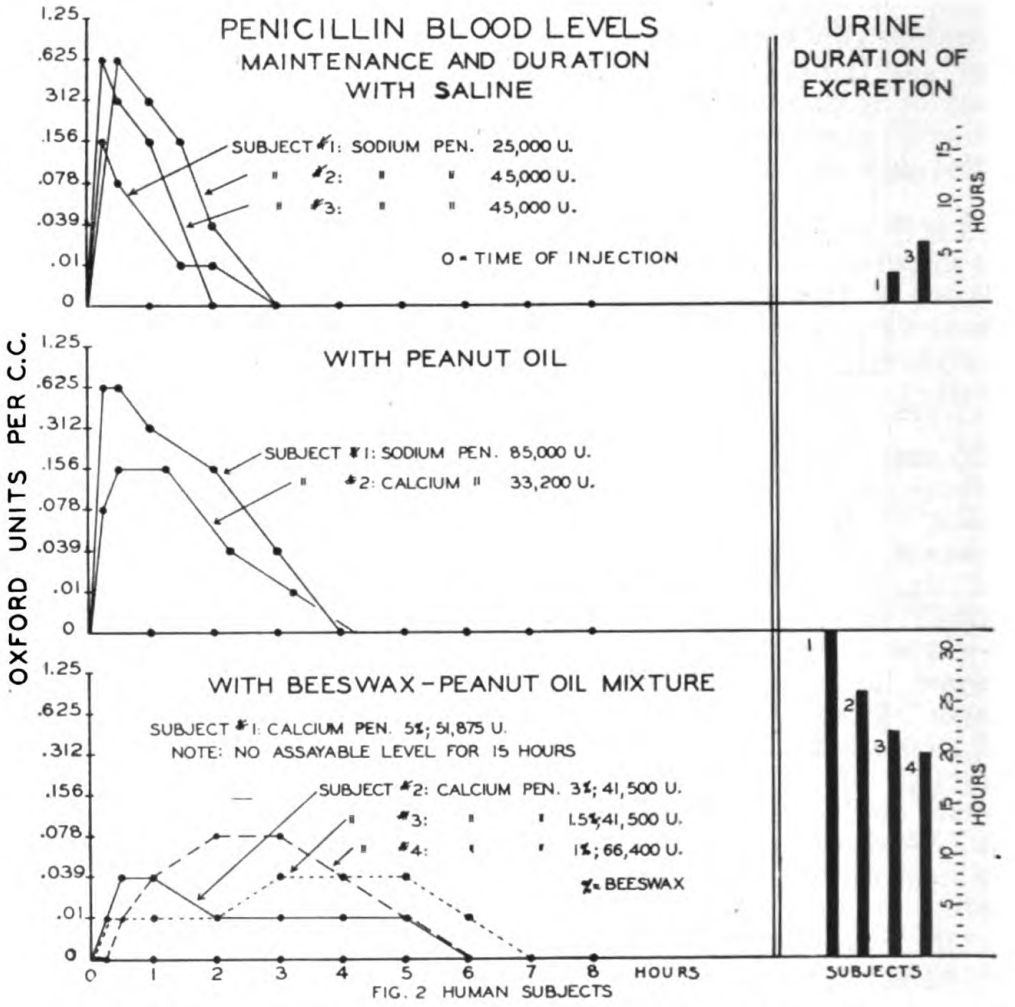


FIG. 2 HUMAN SUBJECTS

As pilot experiments, rabbits weighing from 2.5 to 3.5 kg. were injected intramuscularly with 5,000 to 10,000 Oxford units of penicillin contained in 1 cc. of beeswax-peanut oil mixture and blood assays[9] were made to determine the duration and maintenance of effective levels. Figure 1, which is typical of results obtained in a series of rabbit exper-

*Assays were made by the methods of Rammelkamp[9] and Rake.[10] Penicillin assays of the urine were also done by these methods.

9. Rammelkamp, C. H.: A Method for Determining the Concentration of Penicillin in Body Fluids and Exudates, Proc. Soc. Exp. Biol., N. Y., 51:95-97, Oct. 1942.

10. Rake, G., and Jones, H.: A Rapid Method for Estimation of Penicillin, Proc. Soc. Exp. Biol., N. Y., 54:189, Nov. 1943.

iments, compares the levels produced by penicillin in physiologic saline, in peanut oil, and in the various percentages of beeswax-peanut oil mixture.

Human subjects were then given single injections of 41,500 to 66,400 Oxford units of penicillin intramuscularly in the upper outer quadrant of the buttock. These doses were contained in 2 to 2.4 cc. of beeswax-peanut oil mixtures. Bloods were collected for penicillin assay at intervals indicated in figure 2. Figure 2, which is typical of the results

SINGLE INJECTION TREATMENT OF GONORRHEA
WITH PENICILLIN BEESWAX-PEANUT OIL MIXTURE

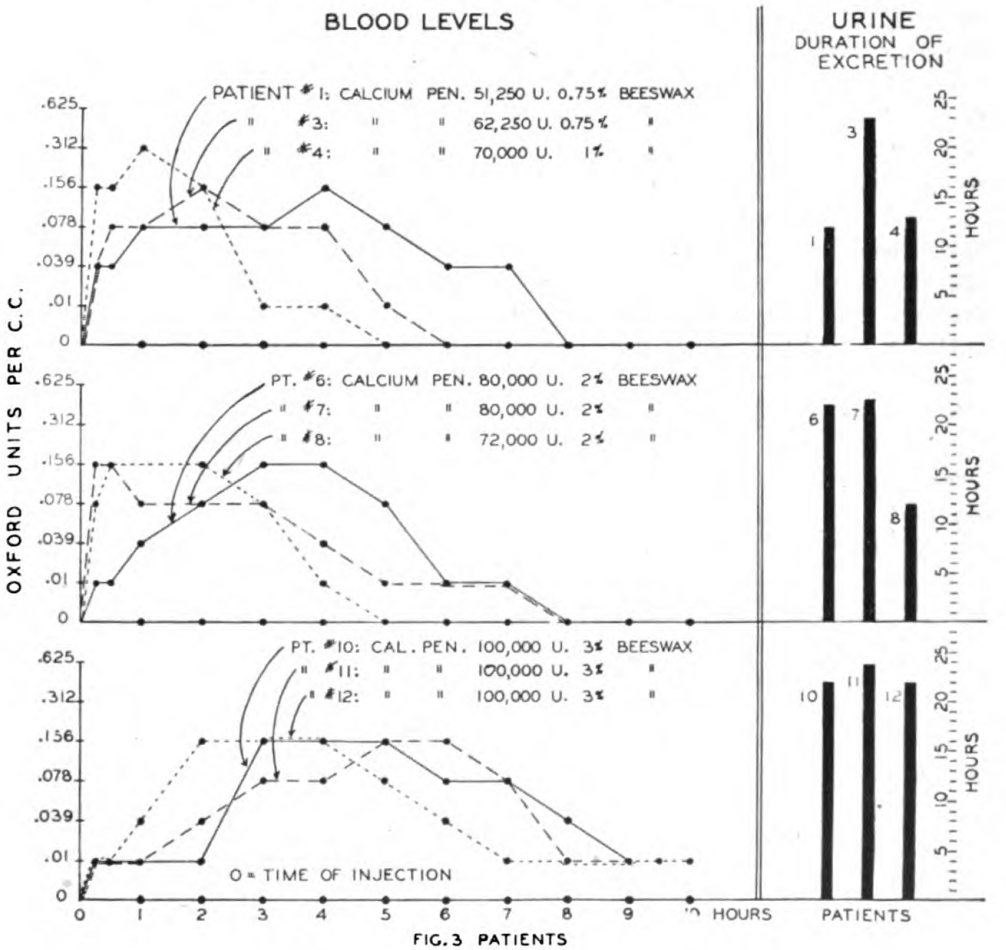



FIG. 3 PATIENTS

obtained with human subjects, shows the maintenance and duration of penicillin levels in the blood obtained by the use of penicillin in saline, peanut oil, and the various percentages of beeswax-peanut oil mixtures. Figure 2 also compares the duration of excretion of penicillin in the urine after the injection of penicillin in saline and in beeswax-peanut oil mixture.

The beeswax-peanut oil mixture delayed penicillin absorption and maintained a level in the blood for six to seven hours. In addition, the presence of penicillin in the urine for

twenty to thirty-two hours indicated a persisting level in the blood for that period of time, though not assayable by present methods.

## CLINICAL TRIAL

The results obtained in the preceding experiments warranted a clinical trial of the penicillin beeswax-peanut oil mixture. Twelve patients* with gonococcic urethritis, three without previous treatment, and nine sulfonamide resistant have been treated with single injections of penicillin beeswax-peanut oil mixture. The doses varied between 51,250 and 100,000 Oxford units contained in 2 to 3 cc. of the beeswax-peanut oil mixture. The 100,000 unit doses were contained in 2 cc. of the mixture, since penicillin in smaller bulk was available at that time. Figure 3 shows the doses given, the levels produced, and the duration of penicillin excretion in the urine in nine of the twelve patients treated. The patients who received 100,000 Oxford units as indicated in figure 3 had no blood assays done beyond the tenth hour.

Of the twelve patients, eleven were cured as evidenced by freedom from clinical symptoms and negative smears and cultures at the end of two, five, and seven days after treatment. Hourly smears and cultures, which were taken, indicate that this preliminary group became negative at the fifth to seventh hour after the single injection of penicillin beeswax-peanut oil mixture.

The only failure was the first patient,† previously untreated, who had received the smallest dose of penicillin, 51,250 Oxford units. The size of the dose does not entirely explain the failure, since the levels obtained in the blood compare favorably (figure 3, patient No. 1) with the levels of patients who were cured and received somewhat larger doses of penicillin. It is likely that the gonococcus in this case was more resistant to the action of penicillin.

None of the patients complained of local pain or irritation in the region where the penicillin beeswax-peanut oil mixture had been injected. The subjects who had received both the penicillin in saline and penicillin in beeswax-peanut oil mixture had a decided preference for the latter. Nothing suggestive of an allergic reaction occurred in any of the patients.

Intramuscular injections of 500 to 1,000 Oxford units of penicillin, contained in 0.05 to 0.10 cc. of 3 percent beeswax-peanut oil mixture, have been given to ten hamsters twice a day for five days. These animals are now being sacrificed at the rate of one per week for the purpose of examining the tissue from the site of injection.‡ The stains used in the

*The cooperation of Captain Robert J. Murphy of the venereal disease ward is appreciated.

†This patient was not re-treated with penicillin in oil but was cured with a total of 100,000 units of penicillin in saline given in five divided injections.

‡Capt. W. S. Randall, pathologist at Walter Reed General Hospital, examined the sections.

histologic studies were sudan, and hematoxylin and eosin preparations. To date, the gross findings have been minimal, consisting of oil cysts 1 to 2 mm. in diameter identified after the seventh day. The tissues at the end of twenty-four hours presented collections of polymorphonuclears between the muscle fibers at the site of injection. No muscle necrosis was associated with this reaction, the fibers being merely separated. The microscopic picture at the end of 10 days was that of a sterile, foreign body reaction with scattered disintegrating leukocytes. Some of the giant cells surrounded particles of beeswax. At the 17th day there was a diminution in the amount of remaining beeswax, which had completely disappeared by the 30th day. The few leukocytes on the 17th and 24th days were of the mononuclear type. Minute cysts having thin fibrous walls with scattered giant cells were seen in sections taken at 24 days. By the 30th day the cyst walls were less cellular and some were partially collapsed.

It is hoped that this method of producing an effective enduring blood level of penicillin will aid not only in determining the optimum amount of penicillin necessary in various diseases but will decrease the number of injections and shorten the time required for treatment. Studies along these lines are now in progress.

SUMMARY

1. Single injections of penicillin in beeswax-peanut oil mixture will produce and maintain levels of penicillin in the blood for seven to ten hours.

2. These mixtures have maintained their potency at room, incubator, and refrigerator temperatures for thirty to sixty-two days and show no signs of deterioration to date.

3. No abnormal reactions, locally or constitutionally, have been produced by this mixture.

4. Eleven of twelve patients with gonorrhea have been cured by a single injection of penicillin in beeswax-peanut oil mixture.

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**Tension.**—Living as a human being often takes more energy than the daily tasks that gain us a livelihood. It is easier to get settled in an occupation than it is to adjust ourselves to the personal side of people. It is one of the peculiarities of man that when his energies cannot be essentially externalized, they dam up within him, within his mind or body or both. The persistent damming up leads to tension and symptoms. When the symptoms are in the mental sphere, they give rise to special names, such as psychosis and psychoneurosis. When the tensions of living localize themselves in different parts of the body, it appears that the organic part involved is the seat of the trouble; that is, the organ appears "diseased." In a broad sense of the word, it is diseased; it is deprived of ease, it is disordered functionally, but the trouble stems from unhappy adjustment to life and not from such organic sources as bacteria and injury. (Leland E. Hinsie, professor of psychiatry, College of Physicians and Surgeons, Columbia University: A Clinical Description of Psychosomatic Medicine, Medical Clinics of North America, pp. 525-552, May 1944)

# Malaria Control in the Army

This is the fourth in a series of articles on malaria. The previous articles appeared in the November and December 1943 and in the February 1944 issues of *The Bulletin*. --Ed.

The menace of many diseases which formerly endangered the lives and health of military forces has largely been removed by the development and application of protective inoculations. Smallpox, typhoid, yellow fever, and more recently typhus, are noteworthy examples; unfortunately malaria cannot be included in this group. Since a method to produce artificial immunity is lacking and no drug is known which will prevent infection, efforts to control malaria must be directed toward the prevention of transmission of the disease by the anopheline mosquito vectors.

Methods for the control of malaria may be divided into two categories. One consists of measures which can be employed at fixed and semipermanent installations in rear areas. These include such procedures as the draining, filling, or oiling of mosquito breeding places and the screening and spraying of living quarters, mess halls, and recreation buildings. These procedures are designated as group measures of prevention and are usually performed by specially assigned and trained personnel. Protective measures of the other category are those that must be employed by the soldier himself. These individual measures include the wearing of protective clothing, the use of bed nets, insecticidal sprays, mosquito repellents, and the taking of suppressive drugs when indicated. The personal protective measures are particularly important when troops are away from base installations during maneuvers or in combat.

The success of group measures for malaria control depends chiefly on the designation of competent personnel to plan and supervise the control program and on the provision of adequate supplies and equipment. The effectiveness of individual measures of protection depends principally on training and the enforcement of a high degree of malaria discipline. Control of malaria in military forces is a complicated enterprise which requires cooperation among all ranks and services. If successful control is to be achieved, responsibilities must be delegated.

As defined in Army Regulations, the primary responsibility for the control of malaria is fixed upon commanding officers of all grades. It is specified (AR 40-210, 15 September 1942, par. 20) that commanding officers, using all means

From the Tropical Disease Control Division, Preventive Medicine Service of The Surgeon General's Office.

at their disposal, will enforce prophylactic measures against insect-borne disease whenever indicated and applicable. Included are: (1) destruction of adult, larval, and egg stages with fumigants, insecticides, and larvicides; (2) elimination of breeding and resting places; (3) selection of camp sites sufficiently removed from breeding places of dangerous insects or from human habitations infested by animal or insect carriers; (4) proper employment of screening, nets, protective clothing, and repellents; (5) prophylactic medication when indicated; and (6) systematic instruction of all personnel in measures for avoiding insect-borne disease. Forthright and intelligent command action is necessary for the efficient administration of control measures and for the establishment of the high degree of malaria discipline which are essential to the prevention of malaria in Army units.

The responsibilities of the Medical Department are prescribed in AR 40-210 and AR 40-205, 31 December 1942, paragraph 21. The surgeon of each command or station is charged with (1) investigating the prevalence, distribution, and significant habits of mosquitoes which may transmit disease to the troops or affect their efficiency, morale, or comfort; (2) recommending measures for control of such mosquitoes; and (3) exercising technical supervision of the execution of the measures to ensure their effectiveness.

The responsibility for the execution of mosquito control work on real property is delegated to the Corps of Engineers (AR 100-80). Such work includes screening of buildings, drainage or filling of breeding places, and the application of sprays and larvicides. The work is performed under the direction of the commanding officer in accordance with the recommendations of the surgeon, who retains responsibility for technical supervision.

The provision of proper supplies and equipment is an important part of a malaria control program. The Medical Department has the responsibility of supplying antimalaria drugs. The Corps of Engineers is charged with the procurement and issue of malaria control supplies and equipment that are used predominantly by engineers (W.D. Cir. No.178, 7 August 1943). These include such items as knapsack sprayers, Paris green, and rotary dusters. The same circular prescribes the responsibility of the quartermaster for procuring and issuing such antimalarial supplies as insect repellent and the aerosol insecticide dispensers ("mosquito bomb"). War Department Circular No. 151, dated 17 April 1944, specifies the distribution of insecticides and pest control equipment. Allowances are authorized according to the probable needs in different geographic areas.

The proper planning and carrying out of group malaria control operations requires specially trained personnel who are familiar with the problems in entomology and sanitary engineering which may be encountered. It is characteristic

of malaria that conditions favorable for transmission vary in different localities. About 60 species of *Anopheles* are known to act as vectors of the disease throughout the world; their breeding and biting habits vary greatly. In one region the important mosquito vector may breed in ponds and swamps; in other places, in running water, and so on. Application of efficient malaria control measures depends on expert knowledge of the local situation.

To meet the need for personnel trained in malaria control, the War Department authorized the establishment of a special medical malaria control organization in oversea theaters. This organization includes medical officers trained as malariologists and survey and control units headed by parasitologists, medical entomologists, and sanitary engineers. In addition to officers, each unit contains eleven enlisted men, most of whom have had specific training.

The assembly and technical training of specialized personnel in sufficient numbers to meet the demands from the tropical theaters has been a problem in itself. The cooperation of the Tennessee Valley Authority, the Rockefeller Foundation, the Florida State Board of Health, and the Pan American Highway Commission has been obtained in meeting this need. More recently, an Army School of Malariology has been established in Panama to provide practical field training for malaria control personnel before they are given oversea assignment.

Malariologists and survey and control units have been sent to all tropical theaters of operation. The units are trained, fully supplied, and equipped before leaving this country. They serve under the command of the theater surgeon and their general function is to plan, supervise, and help carry out measures for malaria control. In addition, they provide technical advice to unit commanders and assist them in developing malaria discipline among their troops. The carrying out of extensive filling, draining, and spraying operations is accomplished by the use of engineer troops and by the employment of native labor when available. In certain hyperendemic areas commanders have ordered that a certain percentage of each troop unit be assigned to assist in the carrying out of malaria control measures. The provision and efficient management of labor forces is an important consideration in group malaria control operations.

The effectiveness of the medical malaria control organization is attested by the marked reduction in malaria rates which has been achieved at many base areas in hyperendemic regions. It is stated in one theater that except for the work of the malaria units, military operations could not have been continued without prohibitive losses from malaria. In another region where construction projects were undertaken in highly malarious territory, malaria rates were kept at only one-tenth the rate estimated by officials familiar with conditions in that area.

At fixed and semipermanent bases malaria control has consisted primarily in the application of standard antimosquito measures adjusted to meet local conditions. The provision of trained personnel together with sufficient supplies and equipment is, in general, proving adequate to meet this phase of the Army's malaria problem, after local handicaps of terrain, supply, and transportation have been overcome. In continental United States exceptionally good control has been achieved at training camps and other installations in the southern states. During 1943 the Army's rate for malaria acquired in the United States was only 0.32 per 1,000 per annum—less than one-twentieth of the rate which prevailed under similar conditions during the last war.

In forward areas, however, particularly under combat conditions, prevention of malaria presents a greatly different problem from that at base installations. Individual measures of protection must be relied on until operations are far enough advanced to permit institution of mosquito control measures. Soldiers must be disciplined in the necessity for making proper use of protective clothing, sleeping nets, insect repellents, and aerosol sprays to prevent bites by mosquitoes. If drug suppressive treatment is prescribed and is to be effective, it is essential that each man take the drug unfailingly.

An understanding of the military importance of malaria and the means of prevention by soldiers of all ranks is necessary for good malaria discipline. To provide this knowledge, War Department Circular No. 223, dated 21 September 1943, prescribes a minimum of four hours of basic instruction concerning malaria. In addition, it prescribes field training in malaria prevention during maneuvers and refresher training when units are alerted for oversea movement. An accompanying circular (W.D. Training Circular No. 108, 21 Sept. 1943) describes in detail the instruction to be given.

Strengthening of malaria discipline is considered to be the most important measure that can bring about a substantial reduction in the amount of malaria among combat troops. Publicity campaigns employing posters, pamphlets, articles in camp newspapers, and radio talks have proved useful in oversea theaters to impress soldiers with the importance of preventing malaria. Examples are numerous where malaria rates of one unit are significantly lower than those of an adjacent unit operating under the same conditions. The difference is invariably explained by a higher degree of malaria discipline in the unit with the lower rate.

In addition to prescribing training in malaria control for all Army personnel, War Department Circular No. 223 also provides for an antimalaria detail in each company, battery, or similar unit. This detail consists of at least one noncommissioned officer and one enlisted man trained in minor maintenance repairs of screening and bed nets, spray-killing

of adult mosquitoes, and minor drainage or larvicidal oiling of small collections of water in and immediately around the area occupied by their unit. In general, the antimalaria details assist their commanders in the enforcement of malaria discipline and in the carrying out of the simpler measures of malaria control.

Observance of ordinary sanitary precautions has little effect on the prevention of malaria. Experience has demonstrated repeatedly that effective malaria control requires special planning and organization. A comprehensive control program needs the full-time attention of personnel trained and designated for antimalaria duty. It should be recognized that few malaria control measures are permanent and that continuous effort must be given to maintain good results. Suitable organization, training, and supplies are now provided for in existing War Department regulations and directives. Coordinated effort on the part of all ranks and services is required to utilize these tools to the best advantage. Because medical officers are frequently required to advise concerning the prevention of malaria, it is particularly important that they be thoroughly informed not only concerning the treatment of malaria but also in regard to its military importance and the various procedures and methods used for prevention and control.

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Men carrying fifty pounds of portable hospital equipment in addition to full field pack in training in Australia. Signal Corps photograph.

# Symptomatic Neurosyphilis

## A Clinical Survey

HARRY C. SOLOMON, M.D., J. E. MOORE, M.D.,
PAUL A. O'LEARY, M.D., JOHN H. STOKES, M.D.,
and EVAN THOMAS, M.D.

The symptoms of syphilis of the nervous system may simulate all forms and varieties of neuropsychiatric disorder. It therefore becomes a postulate that in disorders suggesting organic involvement of the nervous system, whether the symptoms or signs be physical or mental, neurosyphilis must be ruled out before making any other diagnosis. It is equally true that before making the diagnosis of neurosyphilis all physical and psychogenic factors which may be of etiologic importance must be carefully evaluated. As syphilis gives no immunity to other diseases, the coincidence of two disorders is always possible.

Neurosyphilis is that condition in which the tissues of the nervous system, the meninges surrounding the nervous elements, and the blood vessels which traverse the nervous system are invaded by the *Spirochaeta pallida.* To understand the symptoms of neurosyphilis one should bear in mind certain anatomic facts. The central nervous system consists of three types of tissues: the nervous structures, the meninges, and the blood vessels. The latter two tissues arise from the mesoderm whereas the nervous elements are of ectodermal origin. Although the meninges surround the central neural elements and the blood vessels pervade and cut through nervous structures, they are separated each from the other by a limiting membrane.

The pathologic response of the tissues of mesodermal origin to the invasion of the spirochetes is a chronic inflammatory and proliferative reaction similar to that found in the skin and viscera. On the other hand, the nerve cells respond only by necrobiosis. The neuroglia cells, however, increase in number either as a reaction to the invasion of the spirochetes or as a type of replacement scar tissue when neurons have been eliminated.

The difference in the pathologic response, together with the fact that syphilis of the meninges and blood vessels rarely spreads to the underlying or surrounding nervous structure, permits the division of cases of neurosyphilis into two main

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categories: (1) meningovascular neurosyphilis and (2) parenchymatous neurosyphilis. The clinical distinction between those two varieties of neurosyphilis is of importance for (1) meningovascular neurosyphilis produces little or no irreparable damage to nerve cells, except secondarily by interruption of blood supply; and (2) meningovascular cases are much more beneficially affected by trivalent arsenicals and bismuth than are cases of parenchymatous neurosyphilis.

The symptoms of neurosyphilis are directly dependent on the locus of involvement and the extent of the lesion. Theoretically, one should be able with careful evaluation to localize correctly the portion of the nervous system involved. This, however, is not always possible clinically. In a pure meningeal invasion, involvement may be limited to a small portion of either the spinal or intracranial meninges, or it may be very widespread. The involvement may be primarily spinal, at the base of the brain, in the meninges over the vertex of the cerebrum, or confined to an even more limited area. The meningeal inflammation may be slight or extremely extensive, with proliferation in circumscribed areas leading to local pressure.

The symptoms, therefore, of meningeal neurosyphilis will depend on what nervous structures are secondarily involved because of the close juxtaposition of these tissues to the meningeal inflammation and its extent, as well as to whether vascular thrombosis has occurred. Thus a marked inflammatory reaction in the meninges surrounding the thoracic spinal cord may strangulate the cord and cause the symptoms of cord transection. Involvement of the meninges at the base of the brain may lead to involvement of the cerebral nerves as they pass through the pia-arachnoid, causing extraocular muscle palsies, facial paralysis, or interference with function of other nerves. An inflammatory process which interferes with the outflow of cerobrospinal fluid through the basal foramina will produce increased intracranial pressure with all the symptoms and signs incident thereto. The meninges over the vertex may become so thickened as to produce focal or general pressure signs. If focal pressure occurs over the central area of the brain convulsive seizures may ensue. Similarly, involvement of the blood vessels by the syphilitic process may cause damage to any vessel supplying the nervous system; and if thrombosis results, the necessary blood supply will be cut off and nerve cell destruction may result. As practically any vessel may be damaged, leading to thrombosis and perhaps occasionally to rupture, every known syndrome of nervous system disease or disorder may develop.

The invasion of the nervous tissue by the spirochetes (parenchymatous neurosyphilis) may show any type of symptomatology due to injury or destruction of nerve cells. The symptoms are either psychiatric or neurologic, or both. However, in the majority of cerebral cases the frontal lobes are predominantly involved giving rise to the syndrome of gen-

eral paresis. In the cord, the posterior roots and posterior columns of the thoracolumbar cord are most commonly involved, producing the clinical picture of tabes dorsalis.

The clinical manifestations of neurosyphilis may be classified under the following main headings: (1) meningeal neurosyphilis; (2) meningovascular neurosyphilis; (3) tabetic neurosyphilis; (4) paretic neurosyphilis; (5) vascular neurosyphilis; (6) congenital neurosyphilis; (7) various relatively rare and controversial syndromes, such as chronic anterior poliomyelitis, parkinsonism, and disseminated sclerosis-like pictures (these latter are not here described).

### SYPHILITIC MENINGITIS

Meningeal neurosyphilis may be either acute or chronic. Acute meningeal neurosyphilis usually occurs in the first two years of the syphilitic infection. In the early stage of syphilis the meninges frequently show an inflammatory reaction. In most cases, recovery is either spontaneous or a result of routine treatment, but occasionally there occurs the syndrome of acute meningitis of a fulminating type. This is characterized symptomatically by a picture reminiscent of meningoccus meningitis with fever, headache, stiff neck, and Kernig's sign. The spinal fluid may have a pleocytosis up to a thousand or more cells, 40 percent of which may be polymorphonuclear leukocytes. In most cases the meningitis is of a much lower grade with less marked symptoms, consisting chiefly of headache, dizziness, and malaise. The cell count may be normal or as high as 100 to 200 cells.

In acute meningitis, globulin and total protein of the spinal fluid may or may not be greatly increased. The colloidal tests may be of any variety and the complement-fixation or flocculation tests may be either strongly positive or, more rarely, negative.

Acute syphilitic meningitis is relatively rare but probably is seen most frequently in individuals who have had a few arsenical injections and then lapsed from treatment. The response to modern antisyphilitic treatment consisting of arsenicals and bismuth is usually prompt and satisfactory.

Chronic syphilitic meningitis may occur at any time in the late period of syphilis but in most instances symptoms arise within five years of the original infection, although it may be encountered after more than twenty years. Trauma is occasionally an apparent precipitating factor in the development of symptoms. As stated above, the symptoms may be of many types depending on localization and extent of the lesion. Among the syndromes encountered are the following:

1. Meningitis of the vertex is characterized by headache, nausea, vomiting, and convulsions, and when the meningitis is extremely marked the signs of increased intracranial pressure may arise.

2. Meningitis of the base of the brain may lead to involvement of the cranial nerves producing such effects as extraocular muscle palsy, facial paralysis, deafness, and rarely trigeminal neuralgia.

3. Involvement of the meninges surrounding the optic nerves produces visual symptoms due to optic neuritis.

4. Meningitis of the posterior fossa may lead to internal hydrocephalus and the signs and symptoms of increased intracranial pressure.

5. When the meninges surrounding the spinal cord are involved, the clinical manifestations of spinal cord disease including root pains, paraplegia, or even tetraplegia are produced.

6. A rare variety of late meningeal reaction is in the form of a circumscribed swelling or gumma. This is very rare, probably more frequently encountered in the region of the spinal cord than within the skull.

The spinal fluid picture in chronic meningitis may be variable. The cell count may be normal or elevated to several hundred lymphocytes. Globulin may be absent or present in large amounts. Similarly, total protein may be within normal limits or as high as 200 mg. percent. The colloidal tests may be normal or range up to the first zone or paretic type reaction, and likewise the complement-fixation reaction and flocculation tests vary from normal to the most strongly positive. Any combination in the formula of these tests may be found. The diagnosis depends on an evaluation of the combined clinical and serologic evidence. The prognosis, unless tissue destruction from pressure or scarring has occurred before treatment is instituted, is good. Many of the cases are satisfactorily managed with the use of standard antisyphilitic treatment. Others require a pentavalent arsenical or fever therapy.

### MENINGOVASCULAR NEUROSYPHILIS

In meningovascular neurosyphilis there is involvement of the blood vessels as well as the meninges. Probably one type of involvement does not exist without the other, but when there is clinical evidence of vascular disease, the term meningovascular neurosyphilis is used, implying that the meninges are inflamed. The spirochete invades the blood vessel wall and creates the proper condition for the formation of vascular thrombosis. The resulting symptoms depend on the location and size of the vessel thrombosed. Loss of consciousness, attacks of dizziness, and mental confusion occur. The symptoms also include monoplegia, hemiplegia, aphasia, heminanopsia, cerebellar syndromes, and all types of psychotic behavior.

Thromboses rarely occur in the first six to twelve months of the infection. They occur more frequently in the succeeding five to ten years with greatest frequency eight to fifteen years after the infection. Characteristic pupillary signs may or may

not be present. The spinal fluid gives a strong or group III formula in about 50 percent of the cases, whereas in the remaining 50 percent weaker formulas of any variety are found.

The prognosis in treated cases is not altogether bad. There is often a marked improvement of the signs of paralysis or psychosis in a few weeks, but repeated thromboses may occur. Active treatment with trivalent arsenic and bismuth is often successful; pentavalent arsenic is more effective; the combination of fever and chemotherapy is often desirable.

## TABES DORSALIS

Tabetic neurosyphilis (tabes dorsalis, locomotor ataxia) is a type of neurosyphilis in which the posterior roots and posterior columns of the spinal cord show degeneration, with frequent involvement of the midbrain and very probably of the sympathetic nervous system. The major symptoms are ataxia, pain, visceral crises, diplopia, disturbance of bladder and sexual function, loss of visual acuity. These symptoms may occur separately or in combination.

*Ataxia,* which is due to the diminution of the sense of motion and position sensation, is usually first perceived as difficulty in walking in the dark, trouble in making sudden changes in direction, and walking a straight line. Associated with ataxia, there is usually a sensation in the soles of the feet described as walking on cotton or on a thick rug.

*Pain* of an excruciating, lancinating type, often described as if a hot wire were thrust into the flesh or as a pinching of the skin, is very characteristic. Each jab of pain is likely to be instantaneous and repeated over and over again at short intervals for hours or days at a time. Frequently the pain is localized in a small area as in the toe, the heel, the ankle, the calf, the thigh. The pain may jump from one of these areas to another but often remains in the same spot. At first the pains are mild, with long intervals between attacks. As time goes on they become more severe, longer lasting, and more frequently repeated. These pains are often precipitated by cold, wet weather, during intercurrent infections, or on fatigue. There are infinite variations of the pattern. Some patients describe merely attacks of what seem like a feather being drawn across the skin, mild neuralgic pains, or sensations like an electric current being applied to the skin. Many patients suffer from hypersensitivity of the skin, especially about the trunk, so that the pressure of clothes becomes very uncomfortable or getting into a bathtub of warm water is almost intolerable. Some have a sense of constriction about the waist.

*Visceral crises.* The most common visceral crisis is related to the upper part of the gastro-intestinal tract, characterized by attacks of nausea and vomiting with or without severe cramp-like pains or with pain alone. Rectal crises are characterized by pain in the region of the anus and rectum with tenesmus. Sometimes diarrhea, at other times constipation, is

associated. Other crises such as laryngeal spasms occur. Characteristically these crises occur in spells separated by days, weeks, or months. In a typical gastric crisis vomiting may last for days, leading to marked dehydration. There are many variants of the gastric crisis. Occasionally one encounters a patient who has regular morning vomiting. Others speak of periodic attacks of indigestion. Duodenal ulcers are not infrequent in patients with gastric crises.

*Diplopia* is a common occurrence in the tabetic, often the first evidence of the disease. Ptosis of the eyelid is also frequent. Paralysis of accommodation (internal ophthalmoplegia) may also occur. Diplopia is the result of partial or complete paralysis of the third, fourth, or sixth cranial nerve, most frequently the third. The symptom often disappears spontaneously in the first attack but without treatment there is likely to be a recurrence, following which a permanent palsy often results.

*Bladder and sexual disturbances.* Loss of bladder sensation leads to distention, loss of tone, and overflow incontinence. Patients often boast of their capacity to hold the urine all day. After voiding there is usually considerable residual urine. Secondary infection and pyelonephritis are not uncommon. Loss of libido and potency is a frequent and sometimes early symptom.

*Loss of visual acuity.* Optic atrophy is a characteristic sign of tabetic neurosyphilis leading to loss of eyesight and complete blindness. Generally it begins with night blindness and more or less rapidly proceeds to complete loss of vision. At an early stage it may be quite difficult if not impossible to differentiate optic retrobulbar neuritis due to an inflammatory process and true tabetic optic atrophy. When optic atrophy occurs, the other symptoms of tabes are usually minimum. The prognosis of optic atrophy is poor and offers one of the severest challenges to our therapeutic skill.

The objective signs of tabetic neurosyphilis include pupillary changes; extraocular palsies; diminution or absence of the knee jerks and ankle jerks; diminution or loss of vibration and position sense of the lower extremities, more marked in the distal portion; Romberg's sign; ataxia; zones of disturbed sensation about the trunk; hypalgesia to pressure on the gonads and the tendo achillis; hypesthesia across the nose and dorsum of the feet.

The characteristic Argyll Robertson pupil (small irregular pupils which fail to react to light but which react during accommodation) is found more frequently in tabes than in any other form of neurosyphilis. However, the typical Argyll Robertson pupil is often a relatively late sign and is preceded by irregularity, inequality, and poor reaction to light. Although the tabetic pupil is often small, in some instances wide pupils may be found, and it is not unusual to encounter pupils which respond neither to light nor on accommodation.

Optic atrophy is demonstrated by the pallor of the optic disk, usually associated by loss of visual acuity, frequently by restriction of the visual fields. The recognition of early optic atrophy by ophthalmoscopy is difficult and only possible by an expert ophthalmoscopist.

Tabes dorsalis is evident, as a rule, only after syphilis has existed for five years but may develop at any time during the next twenty-five years. The onset may be insidious, ushered in by flickering pains or by a disturbance in gait or a mild visceral crisis. On the other hand, it may occur suddenly. One occasionally meets a patient who collapses and once helped up is markedly ataxic. In like manner, the onset of a severe gastric crisis may be the first recognized symptom. In most cases, however, pupillary changes and absence of the tendon reflexes of the lower extremities precede symptoms by many months or years. The course of tabes dorsalis is generally progressive, with an increase of symptoms and signs. However, more than a few cases arrest spontaneously or develop a negative spinal fluid.

The spinal fluid findings in tabes dorsalis vary. In many, during the acute stage of advance, one finds a strong formula such as is characteristic of general paresis. Weaker formulas are found even in the early period of progression, and in about 50 percent of the cases there are moderate pleocytosis, a moderate increase in globulin and total protein (50 to 60 mg. percent), a moderately strong colloidal gold and a moderately strong complement-fixation reaction. The spinal fluid may become normal spontaneously, but this is not necessarily paralleled by disappearance of symptoms.

A small percentage of cases respond well to standard antisyphilitic treatment. Chemotherapy and fever therapy usually arrest the progress of the inflammatory process and the spinal fluid may revert to normal. Unfortunately, however, in many of the cases in which symptoms have existed for some months before treatment is instituted these persist despite the return of the spinal fluid to normal. This has led to much speculation concerning the mechanism of the symptoms in tabetic neurosyphilis and indicates that they are not due in their entirety to the activity of spirochetes.

A late complication of tabes is joint destruction, known as the Charcot joint. This complication is the result of repeated trauma to a joint which has lost some of its normal protective sensitivity to pain. The Charcot joint often occurs in patients who have normal spinal fluids and evidence of complete arrest of the other tabetic symptoms.

### GENERAL PARESIS

General paresis (general paralysis of the insane, dementia paralytica, psychosis with syphilitic meningo-encephalitis) is a psychosis due to spirochetal invasion of the brain. The pathologic changes—nerve cell atrophy, perivascular infiltra-

tion, gliosis, and chronic meningitis—exist for a long period of time prior to the development of mental changes which are the *sine qua non* of the disease entity.

The mental symptoms of general paresis duplicate almost all psychiatric symptom complexes, leading to the well-established psychiatric dictum that diagnosis of mental disease can properly be established only after general paresis has been proved or ruled out. The onset of general paresis is usually insidious, although mental symptoms may begin with extreme suddenness. It is usual to obtain a history that before symptoms were recognized there was a period of months during which the patient had complained of headache, insomnia, capricious appetite, loss of weight, disturbance of sleep, easy fatigability, and difficulty in concentration. This galaxy of symptoms is all too frequently diagnosed as psychoneurosis. In retrospect, it is generally evident that there was a gradual change in the personality and behavior of the individual, with irritability, mild memory loss, poor judgment, lack of care in personal appearance, defect in moral and ethical conduct, and unexplained deviations in character. In other patients the psychosis may be ushered in suddenly by a convulsion or a period of confusion. In many patients one obtains a history that several years before the psychosis was recognized an epileptiform or apoplectiform seizure had occurred, perhaps accompanied by hemiplegia or aphasia of short duration.

General paresis may be divided into several varieties according to the presenting symptoms of the psychosis:

1. A simple dementing form characterized by loss of memory, loss of calculating ability, defects in judgment in association with increasing speech difficulty, and tremors.
2. The grandiose form in which ideas of grandeur and a sense of euphoria are paramount.
3. The manic form in which there is marked similarity to the symptom of the manic phase of the manic-depressive psychosis.
4. The depressed form similar to the depressive form of the manic-depressive psychosis.
5. The agitated form duplicating the agitated depressions of the involutional psychoses.
6. A schizophrenic-like syndrome with paranoid, catatonic, and schizophrenic features.
7. Epileptiform manifestations frequently repeated, often characterized as syphilitic epilepsy.

The neurologic signs encountered in general paresis are variable. Pupillary changes occur frequently but are often absent in the early stage of the disease. Irregularity and inequality of the pupils are the most frequent of these signs found early. Disturbance in the light reaction may occur, with the Argyll Robertson pupil or complete fixation ultimately de-

veloping. Dilated pupils are more frequent than miotic ones. Speech defect or disorder of articulation is probably the most characteristic somatic disturbance of general paresis. A break in the voice, tremulousness, overactivity of the facial muscles, even including the orbicularis oculi, with stumbling over consonants, should raise the question of general paresis. In the early stages, the speech defect is best demonstrated by having the patient repeat difficult test-phrases such as "Methodist Episcopal," "Third Riding Artillery Brigade," but it is often recognizable in spontaneous speech.

Tremor is a frequent and early sign and is seen in the facial muscles, the protruded tongue, and the extended fingers. Rapid alternating movements of the hands and fingers are poorly performed. The tendon reflexes are often exaggerated. If tabes is coexistent, they are diminished or absent. Persistent signs of focal damage, when they occur, suggest that the case is not one of pure paresis.

The course of untreated paresis is downhill, leading to extremely marked mental and physical deterioration and death. In untreated cases about one-half die within two and one-half years of the onset of mental symptoms, and almost all are dead within five years. During the course of this downhill trend, epileptiform and apoplectiform seizures are frequent. An interesting characteristic of the paretic apoplectiform seizure is the tendency for a quick recovery from the apparent focal brain damage. Following each convulsive attack increased mental deterioration may ensue. From 10 to 20 percent of patients have spontaneous remissions, lasting for several months to a year, followed by relapse.

The spinal fluid in general paresis is characteristic. The cell count varies from normal to 80 or more per cu. mm., globulin is present in large amounts, the total protein varies from 75 to 150 mg. percent, the colloidal gold test is of the first zone or paretic variety. The complement-fixation and flocculation tests are strongly positive. Only very little variation from this formula is consistent with the diagnosis of general paresis.

The prognosis of general paresis under treatment is in the majority of cases an arrest, with some residual defect, the extent depending upon the amount of damage which occurred before treatment became effective. Every case in which the physical state of the patient permits should have fever therapy as well as chemotherapy.

### VASCULAR NEUROSYPHILIS

Purely vascular neurosyphilis without concomitant meningeal involvement (see "Meningovascular Neurosyphilis") is a questionable entity. There has been much discussion concerning the diagnosis of vascular neurosyphilis in syphilitic patients who have cerebral vascular accidents and a normal spinal fluid. It is our opinion that these are usually instances of degenerative arteriosclerosis or hypertension in syphilitic individuals and not primarily neurosyphilis.

CONGENITAL NEUROSYPHILIS

Juvenile neurosyphilis is the term given to neurosyphilis occurring in patients with congenital syphilis. The symptoms may be similar to those seen in the adult form of neurosyphilis and usually appear during childhood or adolescence. The most common is that of juvenile paresis. Juvenile tabes and other forms are great rarities.

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# Pathology of Atypical Pneumonia

Ninety autopsy cases of patients dying of "atypical pneumonia, etiology undetermined" were made available for study by the Army Institute of Pathology of the Army Medical Museum. Analysis of the material revealed that the basic pulmonic lesion was an acute interstitial pneumonitis, which in cases uncomplicated by secondary bacterial invaders, showed involvement of variable numbers of bronchioles. The limits observed varied from a portion of one lobe to diffuse bilateral lesions. The unit of the pathologic process consisted of slightly raised, whitish, firm, thickened bronchioles, from which pus exuded or could be expressed. They were bordered by a narrow, indistinct zone of congested or hemorrhagic lung tissue and separated from other involved bronchioles by patches of aerated lung tissue. The lesions resembled a miliary granuloma on superficial examination. In cases uncomplicated by secondary bacterial invasion, evidence of frank pulmonic consolidation was lacking.

Microscopically, the chief lesions may be summarized:

1. The affected bronchioles showed an inflammatory picture with certain uniform features:

a. Partial to complete ulceration of the bronchiolar mucous membranes.

b. Bronchiolar lumens were filled with frank pus, desquamated mucous membrane cells, and mucoid fluid. Sometimes an air bubble was trapped in the exudate.

c. The bronchiolar walls were heavily infiltrated by mononuclear cells, in which plasma cells, lymphocytes, and large monocytes predominated. Edema of the wall was a prominent feature.

2. The peribronchiolar mononuclear cell exudate extended radially into the regional lung framework, thickening the alveolar walls.

3. The lung septa were edematous and contained mononuclear cells. Lymphangiectasis was a constant finding.

4. The alveolar spaces were frequently air-containing, but their contents were variable even when different portions of the lungs of a given case were examined. Specimens un-

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Abstract of paper by Major Alfred Golden, M. C., A. U. S. The complete paper will be published in the Archives of Pathology.

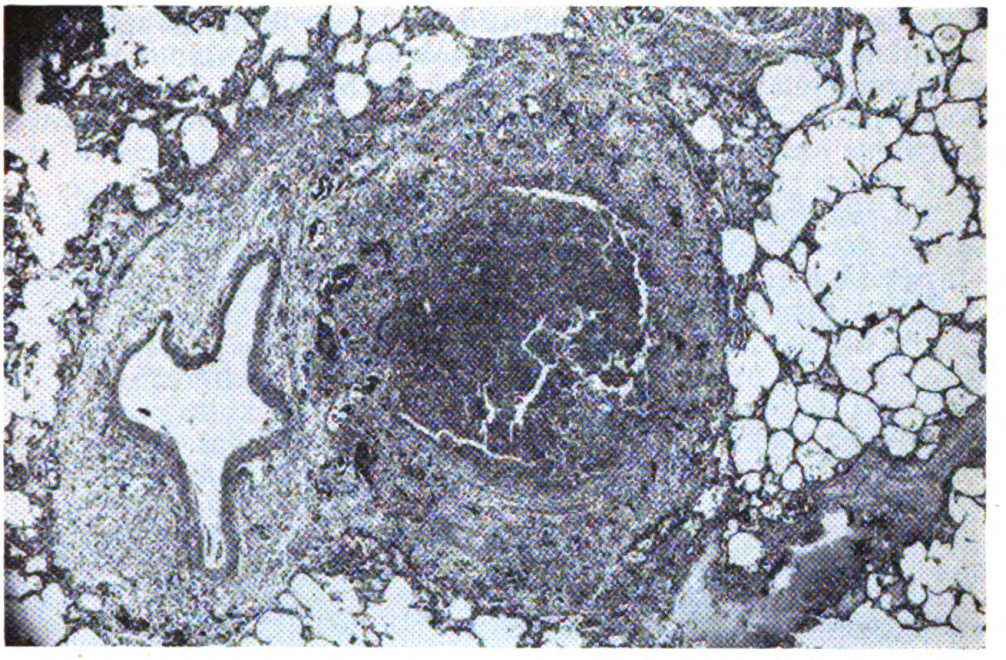

FIGURE 1. An inflamed bronchiole shows a lumen filled with pus, partial ulceration of the mucous membrane, and wide edema of the wall with round-cell infiltration. Negative No. 81,217, Army Medical Museum Accession 96,956. 30X.

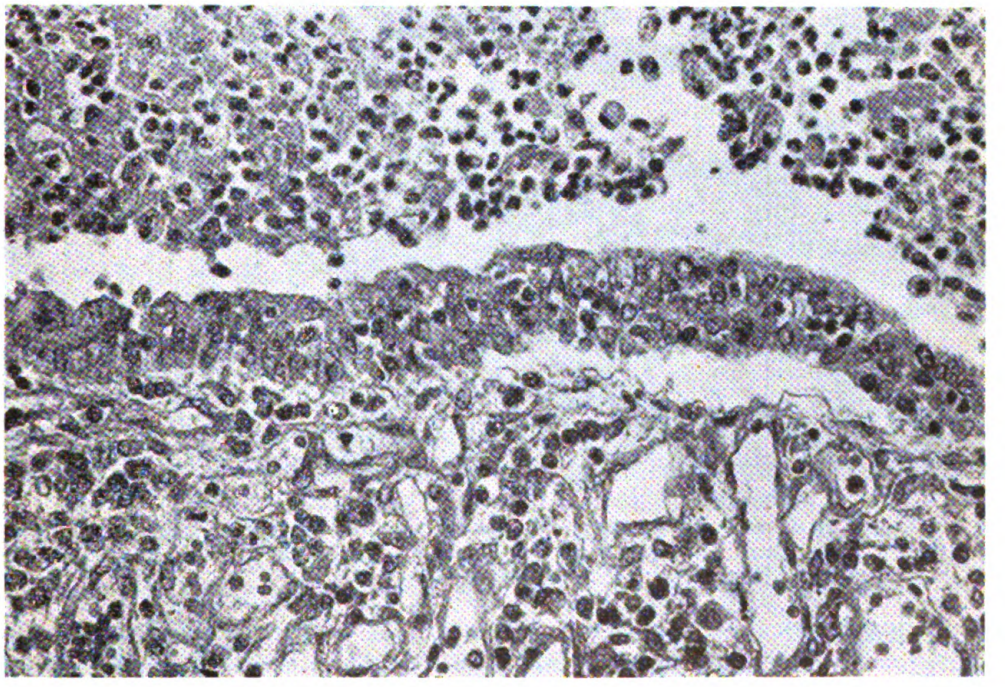

FIGURE 2. A high-power view showing the polynuclear leukocytes in the bronchiolar lumen (up) and the lymphocytic and plasma-cell infiltration of the wall (below). Negative No. 80,912, Army Medical Museum Accession 79,032. 500X.

complicated by secondary bacterial invasion did *not* show polynuclear leukocytic exudation in their lumens such as is found in lobular or lobar pneumonias. Some alveolar spaces contained edema fluid, with and without the formation of eosinophilic, homogenous, hyaline membranes; others showed fibrinous balls without polynuclear leukocytic admixture; and still others contained masses of unorganized hemorrhage.

5. Dilatation of affected bronchioles was common. In some areas from four- to fivefold increase in bronchiolar diameters was seen. Where dilatation was marked, one could demonstrate disruption of the muscle coat, of the elastic tissue fibers, and of the reticulum meshwork. In less extreme examples of acute bronchiolar dilatation, no such abnormalities of the wall were seen. It is in accord with the known processes of repair that the latter type of lesion could heal by complete resolution and that the former could go on to peribronchiolar

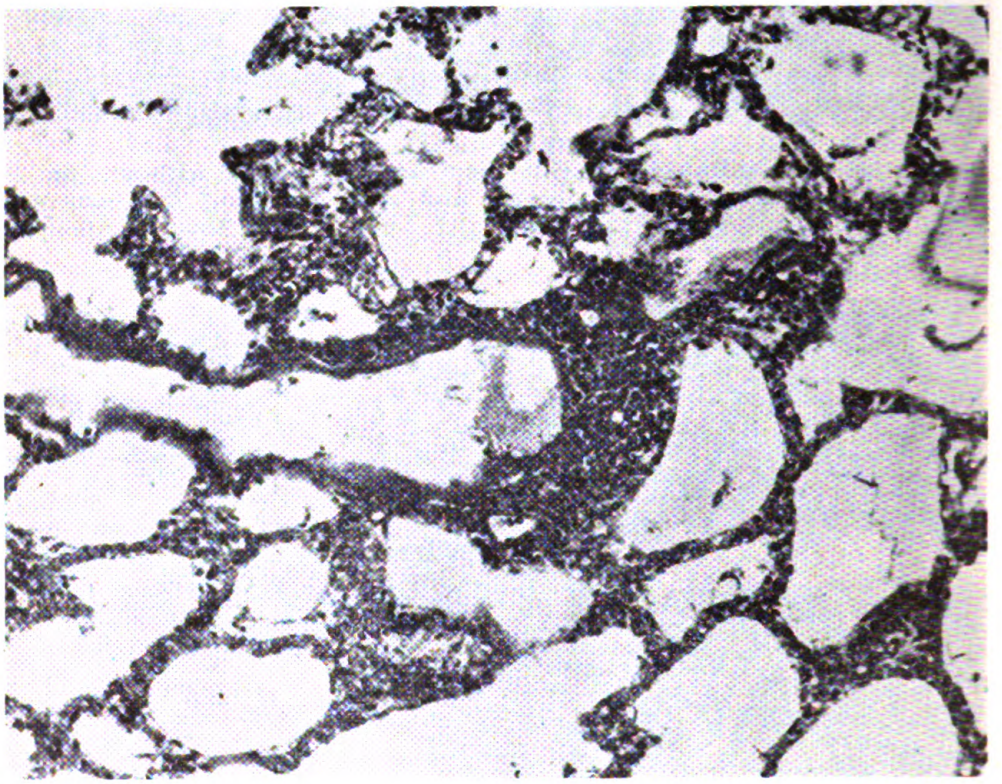

FIGURE 3. Great thickening of alveolar walls by dense round-cell infiltration. Note that the alveolar lumens are air-containing. Negative No. 74,285, Army Medical Museum Accession 79,032. 300X.

scarring and persistent dilatation. To date no *pathologic* examples of chronic bronchiectasis on the basis of acute interstitial pneumonia have come to our attention.

6. Bacterial stains of lung sections uniformly failed to reveal microorganisms in affected alveolar walls, alveolar lumens, peribronchiolar tissues, lung septa, or bronchiolar

walls. Small numbers of organisms of nonuniform type were found at times in the bronchiolar lumens, mixed with the purulent exudate. Such bacteria were interpreted as contaminants derived from the upper respiratory flora, playing no *direct* role in producing the pulmonic lesions.

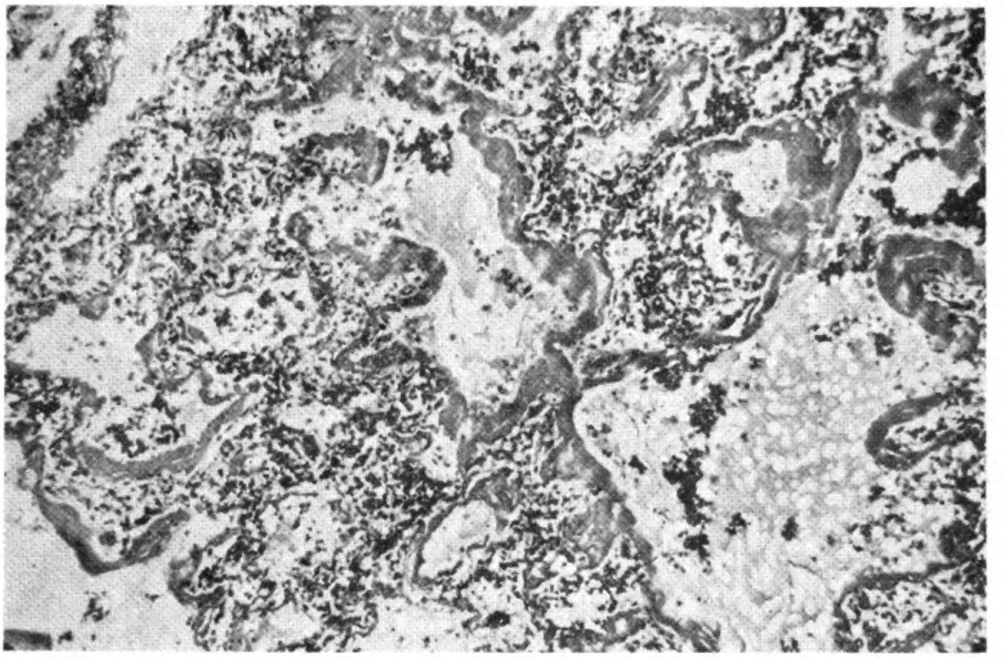

FIGURE 4. Some alveolar lumens are lined by bandlike masses of homogenous, eosinophilic material, hyaline membranes, or "crescents." Other lumens contain serous exudation and clumps of red blood cells. Negative No. 80,593, Army Medical Museum Accession 71,380. 120X.

7. The larger branches of the bronchial tree showed only edema, congestion, and round-cell infiltration in the submucosa.

8. In a few cases, patches of fibrinous pleuritis were found, free of bacteria in tissue sections, with edema, congestion, and round-cell infiltration of the subpleural tissues.

### CEREBRAL LESIONS

Cerebral lesions were seen in four cases. Grossly, the intrinsic vessels were congested and small focal hemorrhages were observed, apparently without specific structural localization. Microscopically, the hemorrhages were unorganized, perivascular, and some were large enough to fill one-half of a low-power microscopic field. Except for their inordinately large size, such hemorrhages were compatible with those seen in anoxemic states. Other findings associated with the hemorrhages set them apart from simple hemic extravasations. For example, some hemorrhagic foci had necrotic centers while others showed glial proliferations around them. Regional to the hemorrhages, occasional vessels had small glial collars. Isolated necrotic foci were seen without associated

hemorrhage. The exact interpretation of this type of hemorrhagic encephalopathy must await the demonstration of an etiologic agent, and the analysis of such cerebral foci for that agent. Meningitis was not found in these cases.

The pulmonic lesions in "atypical virus pneumonia," as seen in our series, have certain similarities to those seen in experimental swine influenza, epidemic human influenza, and uncomplicated measles pneumonia—all are of viral origin. Therefore, the presumption is strong that atypical pneumonia is viral in etiology as well. This hypothesis is strengthened by the fact that search of the lung tissue sections for bacteria revealed none of significance.

As in the other virus pneumonias, there is a great tendency toward secondary bacterial infection. When that occurred in the last influenza pandemic, there were described hemorrhagic pneumonias in geographic areas where streptococcal invasion was common, lobular and lobar pneumonias where pneumococci or Friedländer's bacilli predominated, and abscesses, for example, where staphylococcal invasions were the rule. A similar situation existed in the study of the present series. In a number of cases the lesions of acute interstitial pneumonitis could be separated from the superimposed pulmonic consolidations by examining different portions of the lungs. In fact, unless such a partition of lesions existed, it was not possible to state from the pathologic examination that a superimposed bacterial infection was present. Where the separation of pathologic processes was impossible, the lesions were indistinguishable from ordinary bacterial pneumonias.

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**Neurotic Reactions in Soldiers.**—A neurosis is a form of illness associated with internal problems of the personality, representing a failure of adaptation to circumstances. Its origin is the psyche, it is geared to inner mechanisms, yet its expression is strongly influenced by external forces, appearing in different regions and with fluctuating intensity. A neurosis is sometimes rooted in constitutional soil but is cultivated and grows through life's experiences. The example of neurotic illness among parents, the insecurity of an unhappy childhood, alternative parental affection and hostility, conflicts of the child between impulse and inhibition never resolved but repressed, such impacts and experiences fashion a pattern of personality in which fear is strong and sickness becomes a compromise solution for internal and external problems. The psychoneurotic thus grows up somewhat insecure and timid, concerned with himself and his organs, overly fearful, the fear expressing itself by motor signs or visceral betrayal, inclined to introspection and anxiety. There is an undue amount of fear and doubt in ordinary life, a dependence upon parents, a concern about self—all of which is transformed into disturbed visceral action and manifested by a great variety of symptoms. In its severe form a neurosis may be chronic and cause disabling symptoms. Yet normal persons, faced with threats or weakened by a series of unfavorable situations, develop symptoms similar in form but usually of a temporary nature. (Introductory paragraph in a paper by Major Joseph Fetterman, M.C., submitted for clearance through The Surgeon General's Office, 17 January 1944. The author states that he uses the terms "neurosis" and "psychoneurosis" interchangeably.)

# Vincent's Infection

It is commonly believed that the organisms primarily responsible for Vincent's infection are Vincent's spirochetes and fusiform bacilli, which may be found in nearly all normal, healthy mouths. Considerable evidence is available indicating that these organisms become pathogenic when the vitality of the tissues becomes impaired. The opinion prevails that Vincent's gingivitis or stomatitis is a primary infection which must have a predisposing cause, such as poor oral hygiene, local irritation, debilitating disease, or malnutrition.[1] [2]

According to Thoma,[2] "The contagiousness of the disease is illustrated by its occurrence in several individuals of the same family or in the inhabitants of one college dormitory. The disease is transmitted through the use of eating and drinking utensils previously infected, such as may be encountered especially in restaurants and roadside stands; when eating food infected by another person; by the use of infected cigars, cigarettes, pipes, lead pencils, doorknobs, and towels that may contain the infection; by kissing and other direct contact, passing one's fingers into the mouth of an infected member of the family and thus infecting one's own."

An article sponsored by the Council on Dental Health of the American Dental Association, written by Harry Lyons, D.D.S.,[3] contains the following about contagion: "Considerable debate still prevails in professional circles regarding the possibility of transmission of Vincent's infection of the mouth. The large number of cases that have been reported at various times is cited in support of this contention. However, many other facts point to the contrary. The occurrence of large numbers of cases in an Army or institution may just as readily be due to the debilitating conditions under which large numbers of individuals live, a commonly prevailing dietary deficiency, etc. Under such conditions, an outbreak of the disease in considerable numbers cannot properly be called an epidemic. As a matter of fact, the transmission of this disease in man has never been scientifically demonstrated. However, patients suffering from Vincent's infection of the mouth, particularly the acute form, should be advised to exercise the simple sanitary measures usually practiced in other instances of acute oral or respiratory disease."

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From the Dental Division of The Surgeon General's Office.

1. Goldman, H. M.: Periodontia: A Study of the Histology, Physiology, and Pathology of the Periodontium, and the Treatment of Its Diseases, pp. 78-84, 382. St. Louis: C. V. Mosby Co., 1942.

2. Thoma, K. H.: Oral Pathology, 2d ed., pp. 688, 704, 1240. St. Louis: C. V. Mosby Co., 1944.

3. Lyons, Harry: Vincent's Infection of the Mouth, J. Am. Dent. Ass., 30:759-761, 1 May 1943.

The incidence of Vincent's infection in World War II has been lower than expected thus far in this country and overseas. There are no specific rates for World War I to compare with the figures for the present war. The history of the last world war, however, indicates that the infection was both prevalent and severe.

Rates for the entire Army show the trend and the relatively small increase evident so far (table I).

TABLE I

| Year | Rate per 1,000 men per month total Army | Percentage increase over 1940 |
|---|---|---|
| 1940 | 2.23 | |
| 1941 | 2.43 | 9 |
| 1942 | 2.64 | 18 |
| 1943 | 3.38 | 51 |
| 1944 | 3.33 | 49 |

Table II shows rates for continental United States and those from overseas.

The significant fact is that the overseas troops have a lesser experience of infection than those in continental United States. Certainly, soldiers in the United States brush their teeth as much as those overseas, and the nutritional intake of troops in foreign theaters is not superior to that in this country. Soldiers in the United States should not have as many, and certainly not more, adverse living conditions than those overseas.

TABLE II

| Year | Rates per 1,000 men per month—continental United States | Overseas |
|---|---|---|
| 1942 | 2.89 | 1.03 |
| 1943 | 3.66 | 2.34 |
| 1944 | 3.80 | 2.60 |

An incidence of 10.8 per 1,000 men per month was reported in one foreign theater. These troops were in training; however, they were frequently in relatively close contact with civilians. This high rate was reported during April 1943, but the rate dropped to 4.6 by December 1943. With this high figure in the one theater, the average for all overseas troops that month was only 3.12. During April 1943 in the theater that experienced the most combat, the rate was only 3.04. No other foreign theater had an incidence of more than 2.75, and in three theaters it was 0.80 or less.

The data available during World War II tend to support the theory that Vincent's infection is contagious and that troops in frequent contact with the civilian population, public restaurants, and public places of entertainment are more vulnerable to the infection than soldiers who are isolated; furthermore, the figures show no regularity of low or high during any season or month of the year.

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**Mules.**—The Quartermaster Corps is purchasing about 2,000 mules for the use of the armed forces. The mule is proving more valuable than ever to the Army for supply transportation over rough terrain such as has been encountered in Sicily, Italy, and Burma.

# Original Articles

## Control of Bacillary Dysentery in a Tropical Outpost

### Report of 1,000 Cases

CAPTAIN WILMORE B. FINERMAN
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and
MAJOR JAMES E. WEISS
Sanitary Corps, Army of the United States

In the last ten months, more than 1,000 cases of proved bacillary dysentery (*Shigella paradysenteriae*), acute enteritis not proved at the time of hospitalization to be bacillary dysentery, and carriers have been admitted to a station hospital in the Central Pacific Area. The methods used to control the spread of bacillary dysentery are outlined in this report.

On this tropical island, troops are stationed by units each having its own mess hall and pit latrines; in a few instances, men from several organizations eat in one mess hall. Beginning in September 1942, a large number of cases with diarrhea reported daily to the station hospital. At first, only certain units were represented but soon it was apparent that an epidemic of bacillary dysentery had begun. Because of faulty construction and poor maintenance, flies were breeding in numerous latrines which were used by active cases of dysentery and by dysentery carriers. Evidence was obtained of direct transmission of the disease by food handlers who were proved to be carriers. It was decided to examine all units for bacillary dysentery carriers and all men with a previous record of diarrhea, and to hospitalize all men found with active diarrhea or with complaints of abdominal cramps and those who were proved to be carriers.

The sanitation of each unit area was rigidly inspected, and extra precautions were taken to protect food against contamination by flies and food handlers. Lectures on sanitation, with charts and exhibits, were given to all officers of the command by the hospital staff and attendance was compulsory. The construction of additional sanitary facilities was given a priority exceeded only by the construction of vital defense. Incoming and outgoing troops were examined individually; outgoing personnel

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submitted three stools for bacteriologic examination before leaving. More than 17,000 stool examinations were made.

Among the organizations first examined, about 11 percent were found to be carriers of *Shigella paradysenteriae.* Higher carrier rates were found in units with greater admission rates. The percentage of unit "A" admitted to hospital was 19.7, of unit "B," 24.1, of unit "C," 34.2, and of unit "D," 27.3. With these control methods, the percentage of carriers found on subsequent routine examinations dropped to 1.6 percent. Present surveys of troops leaving the island uncovered less than 0.3 percent as carriers, a noteworthy decrease from the 3 percent reported by Dunham[1] and the 7 to 11 percent mentioned by Stitt.[2]

From the standpoint of therapy, two distinct epidemics occurred. Thus the methods of control and treatment evolved during epidemic No. 1 could be applied in epidemic No. 2. Some cases had to be treated symptomatically until sulfaguanidine became available. A comparison between sulfaguanidine therapy and symptomatic care therefore was possible.

## LABORATORY DATA

Fresh specimens of stools were sent to the laboratory in waxed sputum cups and usually the examination was begun in the laboratory within a few hours of defecation; however, some stools were twenty-four or more hours old on arrival. A more recent experience by others[3] would indicate the use of the rectal swab technique. By moving the laboratory to the unit, using rectal swabs, inoculating plates immediately, much higher percentages of isolations have been obtained. However, in the epidemics reported here, this method was not used.

When the stools reached the laboratory, a piece (with liquid stools several loopfuls) was emulsified in 2 percent tryptone broth and allowed to stand for twenty to thirty minutes when a large loopful was streaked onto either SS Agar (Difco) or Desoxycholate-Citrate Agar (BBL). The preliminary emulsification of stools in tryptone broth gave better results than either streaking directly or suspending in saline solution or water. The use of SS Agar and Desoxycholate-Citrate Agar is well recommended in the literature,[3 4] and in the present instance, they were used

1. Dunham, G. C.: Military Preventive Medicine, pages 170-172. Harrisburg, Pa.: Military Service Publishing Co., 1940.
2. Stitt, E. R.: Diagnosis, Prevention and Treatment of Tropical Diseases, 6th ed. Philadelphia: The Blakiston Co., 1943.
3. Hardy, A. V., Watt, J., and DeCapito, T. M.: Public Health Reports, 57:521-524, 1942.
4. Mayfield, C. R., and Gober, M.: Comparative Efficiency of Plating Media for Isolation of Shigella dysenteriae, Am. J. Pub. Health, 31:363-368, April 1941.

indiscriminately, depending on the supply. While no comparative study was made of these two media, daily observations based on more than 17,000 stool cultures indicate that SS Agar is the better medium, because Desoxycholate-Citrate Agar allows the growth of *Esch. coli* to spread in some instances making the isolation of dysentery bacilli impossible. Either medium is, however, a marked advance over the older methods of isolating intestinal pathogens. Considering the large number of stools examined in this study, that all work was done in a field laboratory with no running water, no gas or electricity, and that glassware often was limited, the value of highly selective media which neither require sterilization nor permit gross contamination, can be appreciated.

The streaked agar plates were incubated at 37° C. for twenty-four hours and examined; those that were negative were reincubated for another twenty-four hours and then, if still negative, they were discarded. Plates showing white colonies were recorded and several representative colonies transferred to Russel double sugar. In cases of early active dysentery, practically pure cultures of *Shigella paradysenteriae* appeared on the plates. These colonies were easily identified; in fact slide agglutinations using polyvalent *Shigella paradysenteriae* antiserum could be obtained by suspending these colonies in a drop of water. However, the type of colony varied in the later stages of active dysentery and in the stools of carriers. Almost any whitish colony, even though it had a pink center, might prove to be *Shigella*; hence our policy to always pick several colonies from each plate, inoculating a corresponding number of tubes of Russel double sugar. Triple sugar agar was tried but offered no advantage.

After overnight incubation at 37° C. the Russel double sugar was examined and cultures showing the typical acid butt, alkaline slant, were further tested with specific antisera by means of a slide agglutination. As these epidemics were due to *Shigella paradysenteriae,* a polyvalent antiparadysenteriae serum was used routinely. If agglutination occurred no further routine work was done. In this way the laboratory could report the results on the majority of stools within forty-eight hours; a few stool reports were delayed for seventy-two hours. Some of the *Shigella* isolated were further studied by tube agglutination using absorbed monovalent antiparadysenteriae sera and by cultural reactions. These results will be reported later in this paper.

Occasionally organisms were isolated which gave the typical Russel double sugar reaction but failed to agglutinate with the polyvalent antiparadysenteriae serum. Such cultures were then tested with antisera prepared against *Shigella dysenteriae, Eberthella typhosa, Shigella sonnei, Shigella alkalescens, Shigella* (Newcastle type), and *Shigella dispar*. The failure to agglutinate with antisera was reported as a negative result. Some of these organisms were later studied and found to be species of the *Pseudomonas, Proteus*, and nonpathogenic *Eberthella* genera.

### Laboratory Data

We hoped to give accurate figures on the efficiency of isolation using either SS Agar or Desoxycholate-Citrate Agar, but this was impossible, because occasionally patients did not report at sick call until the acute stages of the disease had almost subsided, and frequently stool specimens were old and dried on reaching the laboratory. In addition, many cases of enteritis not proved to be bacillary dysentery were encountered and counted as failures in isolation. Thus the percentage of isolations were probably lower than the true figures. Despite these objections, 60 percent of all cases of enteritis gave positive cultures of *Shigella paradysenteriae*. Later in this study a selected group was examined. Thirty-two men reported one morning all from the same outfit and all of them exhibited about the same stage of the disease Their stools were cultured without delay. Thirty of the 32 showed positive cultures of *Shigella paradysenteriae* on the first stool examination. The remaining two were found positive with a second stool culture.

A more detailed study was made later of over one hundred of the strains of *Shigella paradysenteriae* isolated. The results of this work showed great uniformity. By macroscopic tube agglutination using absorbed monovalent antiparadysenteriae sera, all the strains were proved to be members of the paradysenteriae subgroup; of these, 97 percent were type W and the remaining type Z. All these strains fermented dextrose, mannite, and levulose, within twenty-four hours. Eighty-six percent of the strains fermented raffinose in periods ranging from three to fourteen days with an average of five to eight days. Ninety-one percent of the strains fermented maltose in periods ranging from two to seventeen days. Ninety-eight percent of the strains fermented arabinose in periods ranging from one to seventeen days. Two strains fermented sucrose. All these strains failed to ferment lactose, xylose, inulin, rhamnose, salicin, dulcitol, glycerol, and sorbitol. All strains reduced nitrates to nitrites, were methyl red positive and acetyl-methyl carbinol negative. Ninety-eight percent of the strains produced indol. The majority of the strains produced a transient slight acidity in litmus milk and then an alkalinity. All strains produced ammonia from peptone, failed to produce hydrogen sulfide and did not liquefy gelatin. All strains were gram-negative, nonmotile, nonsporeforming rods, giving the typical reaction in Russel double sugar and typical colonies on EBM and SS Agar. No cultural differences could be found between the two serological types nor between strains isolated from carriers and active cases. Freshly isolated strains were sometimes atypical in their fermentations but after several subcultures they produced the reactions described.

## TREATMENT

At first, only symptomatic therapy was available—bismuth subcarbonate and paregoric, fluids orally and parenterally where necessary, and maintenance of body electrolytes and nutrition. Blood counts and urine analyses were done only on the more seriously ill as the laboratory was not equipped to handle the increased load. During the second epidemic, each patient admitted had a complete blood count and urine analysis. Facilities were not available for doing sulfaguanidine blood levels.

For treatment purposes, all acute cases were regarded on admission as bacillary dysentery, the final diagnosis being determined by the laboratory results. Where dysentery bacilli were never cultured from the stools, the case was recorded as enteritis but treated as bacillary dysentery. All men with diarrhea were quarantined, using separate and carefully supervised mess and latrine facilities. Medical officers and corpsmen who worked in the quarantined area took special precautions against spreading the infection. They submitted frequent stool specimens, fingernails were kept short, and personal hygiene was emphasized. Pans containing 3 percent cresol solution for hand disinfection were placed by each door of the mess hall, wards, and latrines and frequent admonitions were given to insure their use. Efficacy of control among hospital personnel was shown by the fact that only 5 of the hospital staff (2 carriers and 3 active cases) were hospitalized in ten months.

Daily stool specimens were submitted by patients until the laboratory facilities became overtaxed. It was found that an equally effective check on progress could be had by obtaining stools on alternate days. Carriers were handled in much the same way. A complete card file was maintained on every admission noting the date of admission and the results of each stool examination including the follow-up after discharge.

Carriers and convalescent cases were placed on a working quarantine in the hospital area, but out-of-doors work was omitted during the period of bright sunlight. Constipation, a common sequela of dysentery, was less frequent when this working quarantine was instituted. Then, too, the tactical situation demanded that key men, deemed convalescent, be on duty with their organization during the day. While treatment of carriers without hospitalization has been reported,[5] there were so few of these cases that it was practical to require their return to the

5. Cornell, V. H., Watt, J., and Dammin, G. J.: The Military Surgeon, 92:3, 1943.

hospital for meals and at night. These men were required to scrub their hands with 3 percent cresol solution and were rigidly inspected before leaving the hospital area. They were prohibited from entering their unit mess halls.

### Chemotherapy

All admissions were classified into three categories. Cases were rated as mild if they gave a history of mild diarrhea or abdominal cramping pains or discomfort and were afebrile on admission. Moderate cases comprised those with additional history of tenesmus, malaise, prostration, chills, nausea, or vomiting, and high-grade fever. All received an average of 8 grams of sulfaguanidine, in divided doses, during the first twenty-four hours. Subsequent daily doses were revised in keeping with the response to therapy. Sulfaguanidine was discontinued when a negative stool culture was obtained. The patient was discharged when three additional negative stools without drug therapy were obtained. Carriers were given 6 grams a day in divided doses and discharged when the above criteria were fulfilled.

In the second outbreak both the treatment and the requirements for discharge were revised. The Army's recommended dose[6 7] was used. All admissions with acute symptoms received 3½ grams of sulfaguanidine initially and 12 grams or more in divided doses during the next twenty-four hours. This dose was continued until stools were less than five in twenty-four hours and all severe symptoms were well controlled. Convalescent cases and carriers were given 9 grams a day in divided doses until the newly required three consecutive negative stools on alternate days were obtained before drug therapy was discontinued. Dunham,[1] who states that carriers and convalescents usually excrete organisms intermittently, recommends at least four stool examinations at intervals of not less than twenty-four hours before returning a patient to duty. Where time and facilities permit, he maintains that no convalescent should be discharged until stools are negative for a period of two weeks, as determined by at least four bacteriologic examinations. To test our plan of therapy by these criteria, all cases before being discharged were required to obtain three negative stools on alternate days while on sulfaguanidine and also three more negative stools with drug therapy discontinued. Stitt[2] states that bacilli may continue to

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6. Treatment and Control of Certain Tropical Diseases, Circular Letter No. 33, 2 February 1943, Office of The Surgeon General, Washington, D. C.
7. Guides to Therapy for Medical Officers, Technical Manual (TM 8-210). 20 March 1942, War Department, Washington, D. C.

EPIDEMIC No. 1: CHART "A"

| Disease | Treatment | Number of cases | Symptom classification | Av. daily dose of sulfaguanidine | Av. duration acute stage in hospital | Av. days of therapy | Av. days of total hospitalization | Recurrences | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | As acute dysentery | As acute enteritis | As carrier |
| Proved dysentery (*Shigella paradysenteriae*) | Sulfaguanidine | 117 | Mild | 6.5 gm. | 1.6 days | 7.1 days | 7.3 days | 0 | 1 | 13 |
| | | 139 | Moderate | 6.7 gm. | 2.4 days | 7.2 days | 7.6 days | 0 | 1 | 20 |
| | | 24 | Severe | 6.7 gm. | 3.5 days | 12.3 days | 13.7 days | 0 | 0 | 1 |
| | Total | 280 | | | | | | 0 | 2 | 34 |
| Acute enteritis | Sulfaguanidine | 106 | Mild | 6.6 gm. | 1.8 days | 6.0 days | 6.2 days | 0 | 2 | 7 |
| | | 91 | Moderate | 6.7 gm. | 2.6 days | 6.7 days | 7.3 days | 0 | 2 | 6 |
| | | 3 | Severe | 7.0 gm. | 3.1 days | 9.0 days | 9.2 days | 0 | 0 | 0 |
| | Total | 200 | | | | | | 0 | 4 | 13 |
| (No stools found positive for *Shigella paradysenteriae*) | Symptomatic therapy only | 49 | Mild | 0 | 3.2 days | 4.0 days | 4.3 days | 0 | 1 | 13 |
| | | 69 | Moderate | 0 | 4.0 days | 4.3 days | 4.8 days | 0 | 3 | 11 |
| | | 2 | Severe | 0 | 4.1 days | 4.6 days | 4.9 days | 0 | 0 | 1 |
| | Total | 120 | | | | | | 0 | 4 | 25 |
| Contact carriers | Sulfaguanidine | 211 | | 6.0 gm. | 0 | 7.5 days | 7.5 days | 0 | 0 | 8 |
| Convalescent carriers | Sulfaguanidine | 34 | | 6.0 gm. | 0 | 8.5 days | 8.5 days | 0 | 0 | 0 |

EPIDEMIC No. 2: CHART "B"

| Disease | Treatment | Number of cases | Symptom classification | Av. daily dose of sulfaguanidine | Av. duration acute stage in hospital | Av. days of therapy | Av. days of total hospitalization | Recurrences | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | As acute dysentery | As acute enteritis | As carrier |
| Proved dysentery (*Shigella paradysenteriae*) | Sulfaguanidine | 34 | Mild | 9.2 gm. | 2.3 days | 10.1 days | 17.7 days | 0 | 0 | 0 |
| | | 33 | Moderate | 9.6 gm. | 3.2 days | 10.2 days | 17.0 days | 0 | 0 | 0 |
| | | 2 | Severe | 10.1 gm. | 2.5 days | 10.5 days | 15.7 days | 0 | 0 | 0 |
| | Total | 69 | | | | | | 0 | 0 | 0 |
| Acute enteritis (No stools found positive for *Shigella paradysenteriae*) | Sulfaguanidine | 56 | Mild | 9.1 gm. | 1.6 days | 7.3 days | 14.5 days | 0 | 1 | 0 |
| | | 21 | Moderate | 9.1 gm. | 3.0 days | 7.2 days | 19.0 days | 0 | 0 | 0 |
| | | 3 | Severe | 10.2 gm. | 3.0 days | 7.6 days | 16.7 days | 0 | 0 | 0 |
| | Total | 80 | | | | | | 0 | 1 | 0 |
| Contact carriers | Sulfaguanidine | 91 | | 9.0 gm. | 0 | 8.7 days | 8.7 days | 0 | 0 | 2 |

be discharged in the stools of carriers for six weeks. Intervals as long as three and one-half years have been reported. For this reason additional follow-up stool cultures were taken at intervals up to two or three months after leaving the hospital.

## CLINICAL RESULTS

The clinical results in the two epidemics were quite different. Chart "A" summarizes the findings in epidemic No. 1, and chart "B" the results in epidemic No. 2. As shown in chart "A," there were 280 cases of proved *Shigella paradysenteriae* etiology and 320 of enteritis. The 120 patients with enteritis who received only symptomatic therapy had the shortest hospital stay, because they were treated only until the acute stage was over. Since these admissions occurred before the laboratory was functioning and since a high incidence of carriers was found among them on later stool examination, most of the enteritis cases probably were true dysentery. The data on carriers are separated according to a history of proved bacillary dysentery.

Contact carriers included those men with no official hospital record of bacillary dysentery who were found to have positive stools on routine examination of all units. The 211 contact carriers include the 38 enteritis cases later found as carriers.

Convalescent carriers consisted of previous hospital admissions for bacillary dysentery who were found to have positive stools on routine follow-up examinations. Contact carriers are probably also convalescent carriers who had a very mild dysentery and did not report for hospitalization.

## TOXIC REACTIONS

Toxic reactions were not recorded in this first series of cases. A review of all admission histories and clinical records uncovered no findings of severe reactions. Nine cases are recorded where the initial dose of sulfaguanidine was regurgitated but all subsequent doses were retained.

## DEATHS

One death occurred among the 818 admissions during the first epidemic. This patient was a 24-year-old Caucasian male only moderately ill on admission. He was given the usual therapy of 2 grams initially and 1 gram every four hours, day and night. Death occurred on the second day after admission, without obvious cause. The findings at autopsy were insufficient to account for his demise. The essential gross pathology was a few small areas of hyperemia in the lower one-third of the lower ilium and caecum. Mucosal specimens from these areas

were found positive for *Shigella paradysenteriae*. Those from the rectal mucosa were negative. Tissues forwarded for microscopic examination were lost in transit.

EPIDEMIC NO. 2

The clinical results in the second outbreak are summarized in chart "B," which shows that the number of days of therapy and the period of hospitalization were increased over those of epidemic No. 1. This was in keeping with the revised criteria for discharge from hospital of three negative stools while continuing therapy and three negative stools after discontinuing therapy.

The average duration of symptoms for all acute cases was thirty-six hours. All symptoms were well controlled by the drug. However, one patient in whom ambulatory treatment was attempted had persistently positive stools. When sulfadiazine, 1 gram every four hours, was added to the sulfaguanidine, the stools became negative within forty-eight hours and remained so. There were no deaths in epidemic No. 2.

COMPLICATIONS

Two toxic reactions were attributed to sulfaguanidine in the second epidemic. The first patient was admitted as a contact carrier. No sulfonamides had been taken for at least six months previous to admission. He was given the usual sulfaguanidine therapy for eight days when the third negative stool was recorded and medication was discontinued. The following day he appeared toxic with a temperature of 101.8°, pulse 100, and a red blotchy macular rash over the entire body except for an area clothed by his undershorts. The blood count was within normal limits; the urine was negative for albumin and was clear microscopically except for a moderate number of sulfonamide crystals. The soldier admitted he had taken a sun bath the day before. Except for the fact that his skin was not sensitive to rubbing, this rash might well have been interpreted as sunburn. The following morning his temperature was normal, the rash began to fade, and by the third day all traces had disappeared.

The second patient also was a contact carrier. He had no previous sulfa drug therapy. On the sixth day of therapy his morning temperature was 99.4°. He did not have diarrhea or any subjective complaint. That afternoon his temperature rose to 102.8° and, suspecting a toxic reaction, medication was discontinued. There was no diminution of urine volume; the urine was negative for albumin, but contained a large number of sulfonamide crystals. The blood count was essentially normal. By 6:00 p.m. his temperature had risen to 104.8° with no com-

plaint other than feverishness. On the following morning the temperature had dropped to 101° and within thirty-six hours it was normal. Four days later, as a trial, he was given 3 grams of sulfaguanidine. Within six hours, his temperature was 102.6°; by morning it returned to normal and remained so.

## DISCUSSION

In the first epidemic, 34 carriers for *Shigella paradysenteriae* developed among 280 admissions for bacillary dysentery, a rate of 12 percent. None of these cases had received more than 7 grams of sulfaguanidine daily nor was the drug continued after the first negative stool report. In contrast, none of the 69 proved cases of bacillary dysentery in epidemic No. 2 became a carrier. This improvement was considered due to the larger daily dosage and the increased duration of treatment.

In the first epidemic of 320 admissions for enteritis, 120 received only symptomatic care and 25 (21 percent) of these became carriers. In contrast, only 13 carriers (6.5 percent) developed among the remaining 200 cases of enteritis in epidemic No. 1 even though they were inadequately treated with sulfaguanidine. Substantiating this value of sulfaguanidine therapy, no active cases in epidemic No. 2 became carriers and only 2 contact carriers recurred.

No relation was apparent between the severity of illness on admission, the days of hospitalization, and the subsequent recurrence as a carrier. A definite relation, however, existed between the total dose of sulfaguanidine and the subsequent remission into a carrier state. This is shown clearly when the results of treatment in epidemic No. 1 are compared with the results after the larger doses used in epidemic No. 2.

There was little difference between symptomatic therapy and drug therapy in the control of acute symptoms. Diarrhea, abdominal distress, and tenesmus yielded as readily to sulfaguanidine as to bismuth and paregoric and in about the same number of days. Sulfaguanidine was superior to symptomatic therapy in that patients so treated tolerated a full diet sooner. In the first series of cases in which diarrhea was very severe, combined therapy was tried, but no advantage was noted when compared with the larger doses of sulfaguanidine in epidemic No. 2.

One finding of great interest was the discovery of a large number of carriers in units with only moderate admission rates. In most organizations the number of carriers found equalled or exceeded the number of active cases of bacillary dysentery. The

control of these epidemics depended as much on the elimination of carriers as on rigid sanitation and the hospitalization of acute cases. The discovery and control of carriers can be accomplished only by a laboratory. Stool studies must be made on every man of an involved unit. To hospitalize and follow only men with acute symptoms is to leave fallow this large potent reservoir of future outbreaks.

## CONCLUSIONS

1. Sulfaguanidine has therapeutic value at least equal to purely symptomatic care in the treatment of acute bacillary dysentery (*Shigella paradysenteriae*) and is markedly superior in the elimination of the carrier state.

2. The number of dysentery carriers at large may surpass the number of acute dysentery cases hospitalized. To discover and treat these carriers is no less important than the isolation of acute cases.

3. Acceptance of one negative stool as the criterion for discontinuing therapy accounts for many treatment failures or recurrences with sulfaguanidine.

4. Frequent stool examinations of food handlers, follow-up stool studies of discharged hospital cases, and the examination of all troops arriving at and leaving this command were excellent concomitants of good sanitation in preventing bacillary dysentery. In the control of the carrier state, these methods reduced the rate from 11 percent to less than 0.3 percent.

5. Only two toxic reactions occurred in our series of almost a thousand cases where sulfaguanidine was employed.

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American field hospital near landing field in Sicily from which sick and wounded soldiers are evacuated by C-47 and C-46 transport planes to Africa.

# Use of the Traction Cast in Guillotine Amputations

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The importance of continuous, adequate skin traction following guillotine amputations is universally appreciated. The method which has been most widely used in wartime surgery is the combination of adhesive plaster and the Thomas splint. Early in the Italian campaign it was observed that the adhesive plaster-Thomas splint traction was poorly suited to patients who had to be evacuated soon after surgery, often for long distances. The adhesive plaster traction slipped frequently or became ineffective in transit. Patients often complained of pain in the incompletely immobilized stump and in the groin or axilla where counter-traction was effected by the ring of the standard splint. Dressings were difficult to change without removing the entire apparatus and were found to slip because of the instability of the limb in the loosely fitting Thomas splint. To maintain continuous traction, the adhesive plaster, dressing, and splint had to be observed constantly and frequently adjusted, a task difficult to fulfill in a busy forward hospital or during transportation.

Most of these difficulties are overcome by using the "traction cast." The principle of the method to be described is not new. Various forms of plaster cast immobilization and traction have been used previously. Our experience is based on 54 major guillotine amputations and disarticulations at various levels of both upper and lower extremities. It has been directed that when amputations must be performed in a forward Army medical installation they should be of the guillotine type.[1] While attempts are continually being made to shorten the time lapse between injury and operation, certain factors, such as the tactical situation, the terrain over which evacuation must take place, and the time necessary for resuscitation measures before surgery can be undertaken often hinder such attempts. Despite our situation as a forward evacuation hospital, the time lapse in cases requiring major amputation varied from eight hours to four days and averaged twenty-seven hours.

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Lieut. Colonel M. E. Lichtenstein, M.C., provided helpful suggestions and encouragement. Captain H. Laufman, M.C., provided the drawings and Sergeant P. Shostack, the photographs.

1. Circular Letter No. 91, Office of The Surgeon General, 26 April 1943.

**The essential features of a satisfactory guillotine amputation must be clearly understood in order that the eventual goal of rapid closure of the stump may be uniformly attained. The operation is performed at the lowest possible level commensurate with the status of infection and viability of tissue. Thus, when a secondary revision is done, it can be a closed procedure at the optimal level; however, guillotine amputations do not always**

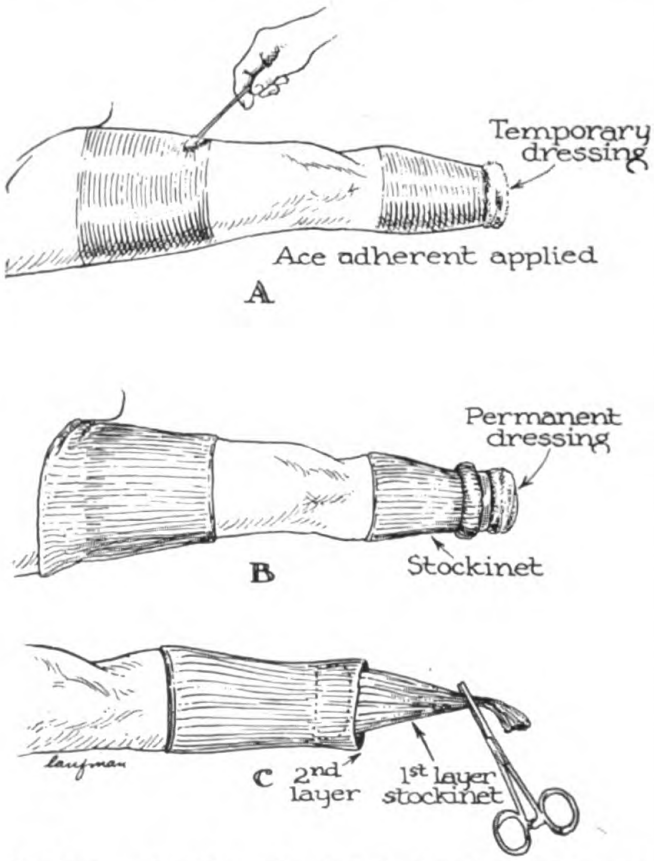



FIGURE 1. A. Gauze dressing is held over the open stump. Ace Adherent is applied with a sterile applicator for about 6 inches up to the very edge of the skin and over a similar area at the upper half of the thigh.

B. Sterile leg stockinet is applied over lower leg from upper margin of the Ace Adherent to 6 inches beyond the end of stump. Thigh stockinet is applied over the Ace Adherent at the upper half of the thigh, extending for 3 inches beyond the proposed upper limit of the cast. The stump is now dressed with the leg stockinet rolled above the edges of the wound, and the dressing then held in place by the converging stockinet and a Kocher clamp, as shown in *C*. The thigh stockinet is later incorporated into the cast and aids in maintaining countertraction.

C. Second layer of stockinet is applied around the leg, extending about 3 inches beyond proposed lower margin of cast, and later is incorporated into the cast, forming a smooth cylinder within which first layer of leg stockinet can glide.

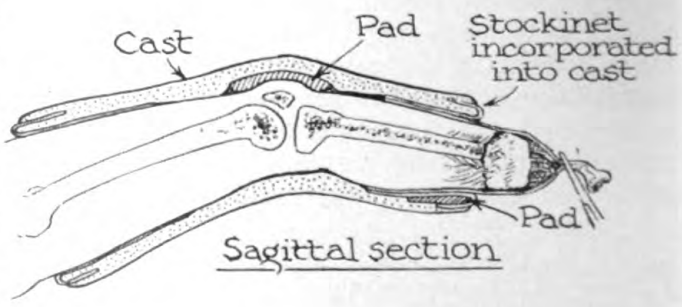



FIGURE 2. Felt pads placed under the posterior surface of the lower leg and over the patella and fibular head are held in place with sheet wadding (not shown), which extends from above patella to within 1 inch of end of stump. Three rolls of plaster are then applied with knee in 10 degrees of flexion, extending to within 1 inch of end of stump. The thigh and leg stockinets are incorporated between second and third rolls of plaster.

require reamputation, especially if the original site of amputation is at a suitable level for the wearing of a prosthesis. Efficient and constant skin traction must be applied early to prevent retraction of the soft tissues.

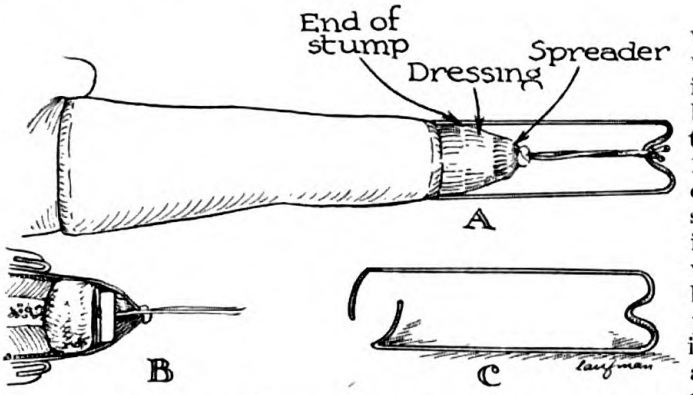



FIGURE 3. A. Previously prepared heavy wire or ladder splint is incorporated into cast by a fourth roll of plaster, extending for about 12 inches beyond end of stump. A circular spreader about 2½ inches in diameter, to which a double elastic band is attached, is then placed against the dressing within the stockinet and held in place by a tie or adhesive strip on the outside of stockinet. By this time the Ace Adherent has become firm and traction can be applied by tensing the elastic band over end of splint. The spreader may be dispensed with and the elastic band applied directly to the stockinet. Traction is reinforced daily by tightening the elastic band.
B. Sagittal section, showing dressing, spreader, and the elastic band.
C. Most commonly used type of wire splint for traction.

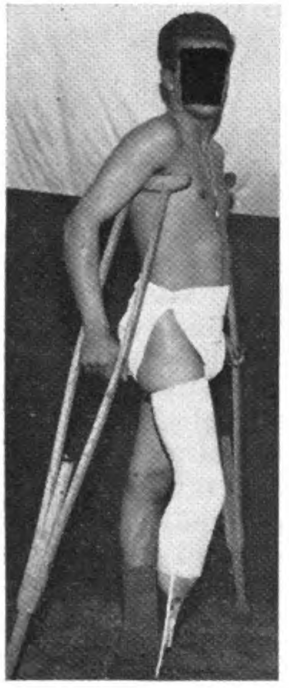
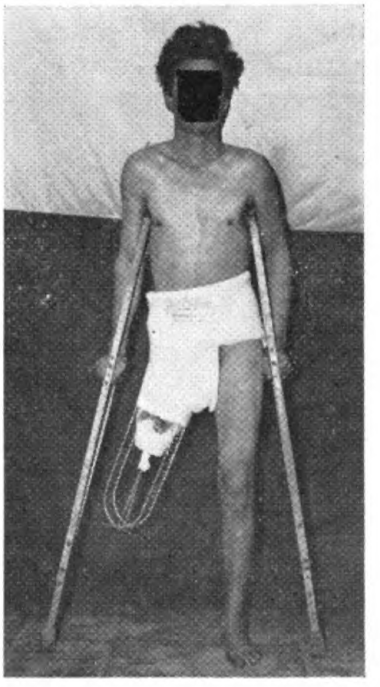


FIGURE 4. Traction cast applied for leg amputation, showing optimal degree of flexion at knee. Patient ambulatory forty-eight hours after operation.

FIGURE 5. Traction cast applied as hip spica for mid-thigh amputation. Cast is molded over felt pads placed over iliac crests. The thigh is slightly flexed on pelvis. Notice Cramer ladder splint used in place of wire splint.



APPLICATION OF TRACTION CAST

The traction cast is adaptable to amputations at any level of either the upper or lower extremity. The method, which is essentially the same in all cases, is demonstrated in illustrations 1, 2, and 3, in the case of a leg amputation. Illustrations 4 to 7 show the applicability of the traction cast to amputations at various sites. The traction cast is applied on the operating table

while the patient is still under anesthesia. The patient is encouraged to be ambulatory as soon after operation as his general condition permits.

The materials used are standard equipment of every forward hospital. They are Ace Adherent, stockinet, sheet wadding, felt, plaster of paris, wire splints, rubber tubing, and adhesive plaster. Spreaders can be made from such materials as wood or the tops of ration and plasma cans.

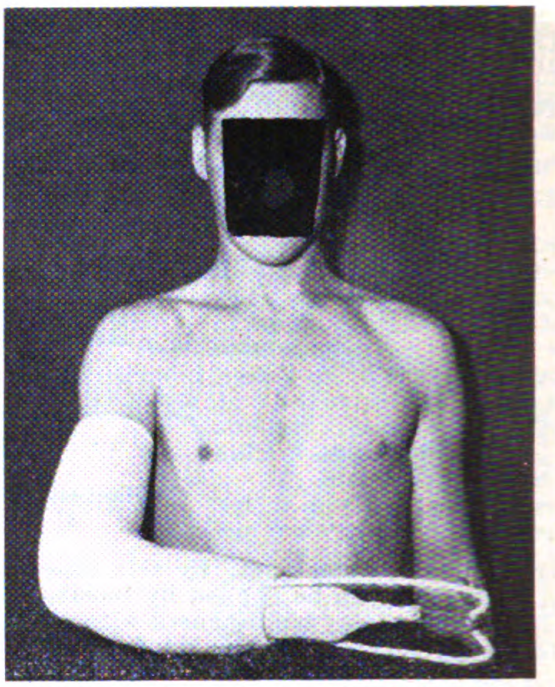


FIGURE 6. Traction cast applied to forearm amputation. The cubital fossa should be well padded. A triangular bandage is applied to support the forearm.

## DISCUSSION

The traction cast is as easily applied as the ordinary type of plaster cast. Variations in the type of cast are easily made depending on the site of amputation. Very little pain at the stump after immobilization in the cast and no pressure areas in the groin or axilla developed. These difficulties were frequently encountered with the usual type of adhesive plaster-Thomas splint traction. A number of our 54 patients with traction casts were observed while in the process of transportation as well as in the general hospitals and they traveled comfortably over bumpy roads. The more rigid immobilization of the limb gave them a sense of security and eliminated wobbling of the stump. The traction cast could be applied satisfactorily to all limbs regardless of length of stump. The shortest was an arm stump measuring 3 inches from the glenoid

FIGURE 7. Traction cast applied to arm amputation by means of modified shoulder spica with Cramer ladder splint extension. In higher arm amputations the ladder splint is incorporated into a body cast in a similar manner.

fossa to the end of the stump. The patients were usually ambulatory after two to three days unless other incapacitating injuries were present. The joint adjacent to the amputation could be kept in the optimal position of flexion without difficulty. Dressings to the stump could be applied easily, held in position effectively, and changed simply by releasing the elastic band and rolling back a layer of stockinet.

Most important, the traction is efficient, effective, and constant. The pull is exerted on the entire circumference of the skin to its very edge. The stockinet remained adherent to the skin in all cases but one, in which it slipped on the eighteenth postoperative day. The traction casts in all cases maintained the length of soft tissues that was obtained by surgery and prevented their retraction. In two cases we were able to close the skin over the end of the stump in our own hospital by means of towel clips applied under local anesthetic after ten days (figure 8).

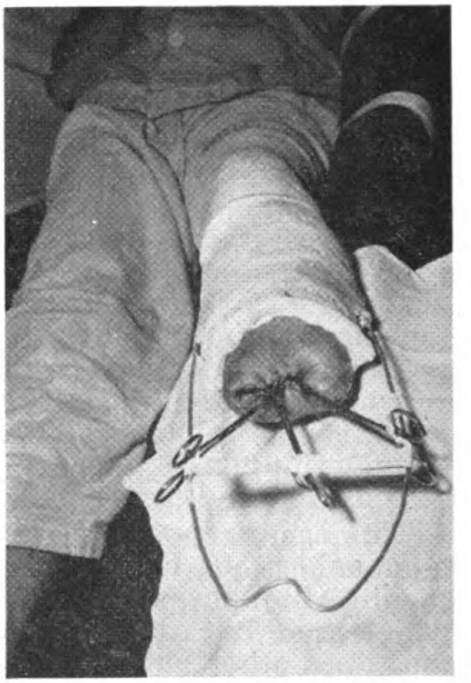


FIGURE 8. Closure of skin edges with towel clips in this case was accomplished in ten days following amputation.

## SUMMARY

This method is believed to be superior to the former method of adhesive plaster and Thomas splint. Plaster traction casts have been used in 54 patients with amputations and disarticulations. The advantages are: ease of application; ready availability of materials; diminution of pain and discomfort while in transit; maintenance of adequate, efficient, constant skin traction; applicability of method to all stumps regardless of length; ease with which dressings are applied and maintained in position; maintenance of limb and adjacent joint in optimal position; early mobilization of patients after surgery; earlier closure of the stump made possible.

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WD Circular No. 208
25 May 44
Sect. VII

Army Nurse Corps. Provides that W.A.C. personnel may be released from W.A.C. for appointment in A.N.C. and in Medical Dept. as dietitians or physical therapy aides, if found physically and professionally qualified for such appointment by S.G.

WD Circular No. 310
20 July 44
Sect. II

Hospital. Refers to par. 21c (11), AR 40-500. C.O.'s of hospitals to insure that nonprofessional personnel be instructed in the necessity of maintaining confidential nature of knowledge concerning individuals and medical matters. Such information will neither be disseminated nor discussed by personnel.

# Primary Atypical Pneumonia

MAJOR LINNEUS G. IDSTROM
Medical Corps, Army of the United States
and
CAPTAIN BENJAMIN ROSENBERG
Medical Corps, Army of the United States

Interest has been stimulated in primary atypical pneumonia because of an apparent increase in the number of cases since the onset of the present war. At Camp Crowder Station Hospital a series of cases was observed which fall within the classification of primary atypical pneumonia but are striking in their difference from the other cases of bronchopneumonia of unknown etiology. In this series, the disease appeared in epidemic form in members of a single company; uniformly negative results were obtained in any effort to determine the etiology;clinical history of cases was unusual; roentgen findings followed a characteristic pattern; the course of the disease and posthospital malaise were prolonged.

The cases reported here occurred in about 40 percent of the members of a company in the Signal Wire Operation School. All of these men belonged to "clean-up teams" which had cleared out dusty, abandoned homes, barns, chicken coops, and other outhouses prior to the installation of Signal Corps equipment. All admissions came within a period of about ten days. The jeep driver, one of the last men to be admitted, was not a member of a "clean-up team," but he took men to and from work and also took the sick men to the hospital. Several men from this company, admitted for other reasons, were found to have the typical roentgen appearance in chest roentgenograms.

Twenty-four soldiers in good health from the company were sent in for x-ray examination of the chest, and in 4 of them a roentgen picture was obtained similar to but less marked than those of hospital patients. The rather typical roentgen picture was also seen in the chest film of a second lieutenant who was in charge of a "clean-up squad" and had been a patient in the officer's ward with a diagnosis of bronchopneumonia.

Most of these patients at the onset, had malaise, later followed by fever, chilliness, dry cough, and vague chest pain. Many of them had severe frontal headaches and a few were prostrate; but in no cases were definite neurological signs elicited. All were acutely ill on admission but none were considered seriously ill. In almost all of the cases, the admission

diagnosis was nasopharyngitis. There was a dearth of physical findings. The chest examination was essentially negative until the fifth or sixth day when a few men developed harsh breath sounds or crepitant rales. White blood counts varied from 5,000 to 12,000 with polymorphonuclear readings ranging from 60 to 80 percent. Special laboratory studies were carried out by a "sampling" method with consistently negative results. In thirteen instances, serums sent to the Virus Laboratory of the Army Medical School and tested for psittacosis, Q fever, and lymphocytic choriomeningitis were negative. The Frei test was negative in six men subjected to the test. Sputum tested in almost every case was negative for pneumococci and other pathogenic bacteria. Sputum examination for fungi and molds on wet culture and after culture on Sabouraud's medium, was negative in five of the cases checked. In two men, examination of the blood for "cold agglutinins" failed to reveal a positive test.[1] Blood culture and examination for parasites were negative in the few cases attempted. Sedimentation rate was elevated in almost 100 percent of the men and was found to correlate well with the activity of the infection.

Roentgen findings were characteristic. Invariably, hilar shadows were increased and peribronchial markings accentuated. Within a few days, subsequent films showed a soft, irregular patchy mottling in the lung parenchyma, quite generalized, with occasional findings restricted to one or more lobes. This patchy infiltration was in definite contrast to the findings of more localized and dense infiltrations that occurred in the usual bronchopneumonias seen during this period. The patchy infiltrations increased as the disease lessened clinically, although activity was further manifest by a persistent elevation of the sedimentation rate and malaise. A very gradual clearing, noted on roentgenograms, was concomitant with regression of sedimentation rate. In four patients, no definite patchy infiltration was seen but accentuated hilar shadows and peribronchial infiltration were noted. An important finding was the appearance and disappearance of some patchy areas of parenchymal infiltration. Atelectasis was not a feature and there was no evidence of pleuritis. Slight changes in roentgen technique producing over-exposure resulted in loss or marked decrease in the hazy patchy mottling which was so characteristic of the roentgen picture.

After a week to ten days of varying constitutional symptoms, which in some men were severe, the patients improved clinically. The majority of the men had temperature elevations of 101° to 102° and occasionally as high as 104°. Morning temperature rise was not a consistent finding but when noted was seen in the patients with the most severe constitutional reactions. The average hospital stay was 30 to 40 days. Two soldiers were discharged on the 157th day (including

1. Peterson, O. L., Ham, T. H., and Finland, M.: Cold Agglutinins (Autohemagglutinins) in Primary Atypical Pneumonia, Science, 97:167, 12 Feb. 1943.

30-day furlough) and on the 177th day still showed findings not appreciably altered as compared with films taken during period of hospitalization. One patient was still hospitalized on the 188th day.

CASE 1. Soldier was admitted on 23 May 1943 with weakness, aches, chills, and fever of two days' duration. Except for mild pharyngitis, physical findings, including chest examination, were essentially negative. X-ray film of chest showed diffuse hilar infiltration and generalized, patchy, parenchymal infiltration, most marked in right lung field. Soldier had high fever for 17 days followed by low grade temperature elevation which slowly returned to normal. X-ray findings (figure 1) remained relatively unchanged. Patient was transferred to a general hospital on the 68th day, still complaining of weakness. On the 76th day patient was granted a 30-day furlough, during which time he complained of moderate dyspnea. He was discharged to duty on the 157th day feeling well except for ease of fatigue; x-ray findings still showed patchy, parenchymal infiltration and accentuated hilar shadows. Check-up film (177 days after initial admission) showed no marked change over films taken at time of discharge from hospital.

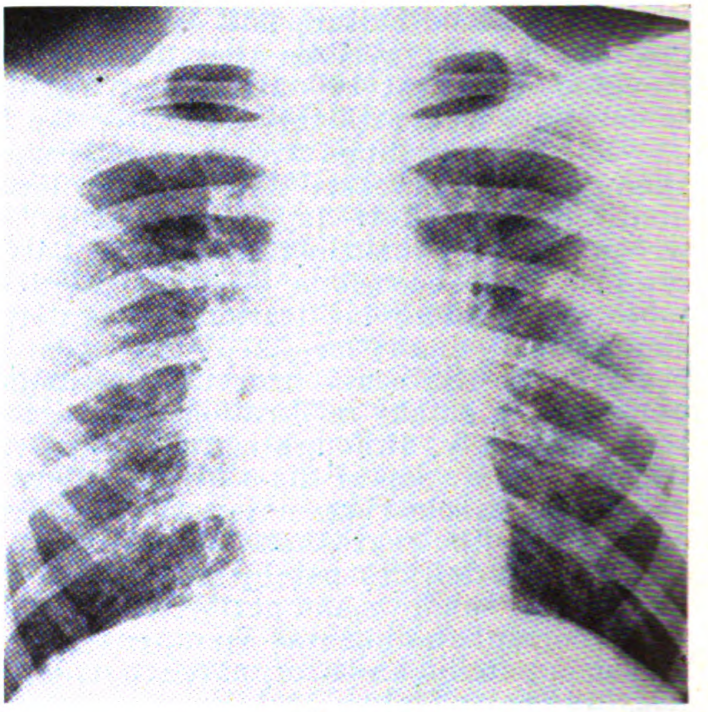

FIGURE 1. Case 1.

CASE 2. A private noted first symptoms on 23 May 1943 and was admitted to hospital complaining of frontal headache, fever, chills, slight cough, and "boring" chest pain. Physical findings showed mild pharyngeal infection; chest was clear. There were 15,000 white cells with 84 percent polymorphonuclear reading. Chest x-ray revealed extensive hilar infiltration with diffuse peribronchial and patchy pneumonic infiltration. This patient improved rapidly except for a persistent malaise and weakness. Sedimentation rate remained high and roentgen findings were relatively unchanged. Patient was transferred to a general hospital (see figure 2) and was granted a furlough, during which period he complained of ease of fatigue and chest pain. He was returned to duty with roentgen findings not appreciably changed and again on the 177th day the x-ray findings still showed extensive hilar shadows and patchy areas of parenchymal infiltration.

CASE 3. Soldier was admitted to the hospital on 29 May 1943 with pain in the back, frontal headache, chills, and fever. Physical findings were essentially negative except for rhonchi and roughened breath sounds on admission examination of chest. White blood count showed 9,400 cells with

66 percent polymorphonuclear reading. Sedimentation rate was 30 millimeters per hour. Roentgen findings revealed hazy infiltration at left base. After a hectic fever of two weeks' duration, temperature approached normal and consolidation in left base decreased in extent. Following a temperature rise to 103° further pneumonic infiltration was seen. On the 52d day following admission patient was discharged improved but was readmitted 21 days later because of recurring malaise, chest pain, and weakness. Roentgen findings at this time (figure 3) showed

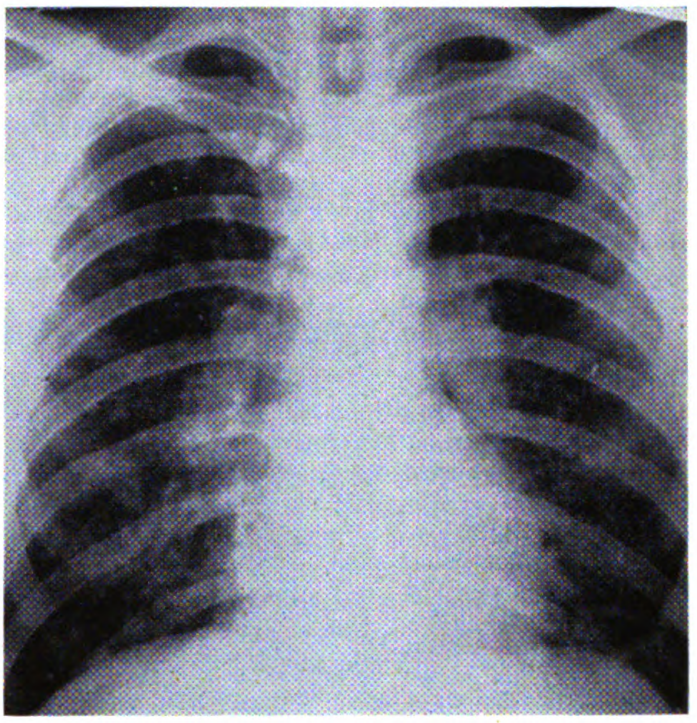

FIGURE 2. Case 2.

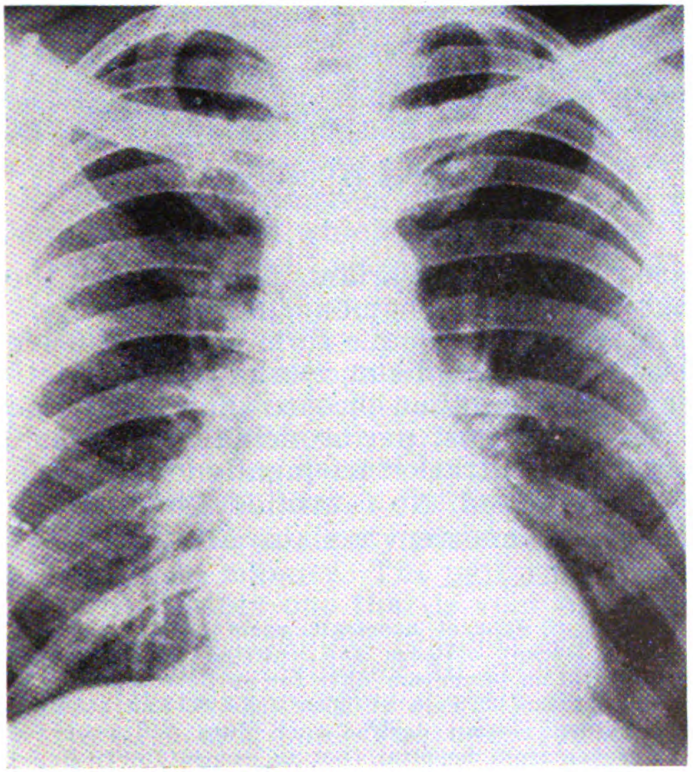

FIGURE 3. Case 3.

an increase in hilar shadows and peribronchial infiltration. Lipiodol studies revealed no evidence of bronchiectasis. On the 143d day following initial admission, patient was transferred to a general hospital and on the 201st day after first admission, he was still hospitalized.

CASE 4. This soldier was admitted on 8 June 1943 with history of generalized aching, cough, and headache of two days' duration. Physical examination revealed no marked findings except for roughening of breath sounds in left chest. Roentgen examination (figure 4) showed hilar and peribronchial infiltration

with additional small scattered areas of soft parenchymal infiltration throughout both lung fields. White blood count was 5,900 with 55 percent polymorphonuclear reading. Sedimentation rate was 33 millimeters per hour. Serum tested for Q fever, psittacosis, and lymphocytic choriomeningitis was negative. He had a low grade fever for two weeks but never appeared seriously ill. On the 41st day following admission patient was discharged to duty and x-ray findings showed resolution of parenchymal infiltration. Four days later he complained of generalized aches and weakness and the following day (45 days after initial admission) was readmitted to the hospital with slight cough, fever, headache, and pain in left chest. Roentgen examination at this time showed a dense infiltration at the left base and crepitant rales were heard in left lower lung field. The picture presented on this second admission was similar to that seen in the usual bronchopneumonia cases and was quite different from his first illness. Fever remained elevated three days (in contrast to an elevation for two weeks on first admission). Recovery this time was rapid. Lipiodol studies revealed no bronchiectasis. Patient was transferred to reconditioning school and is now on duty status.

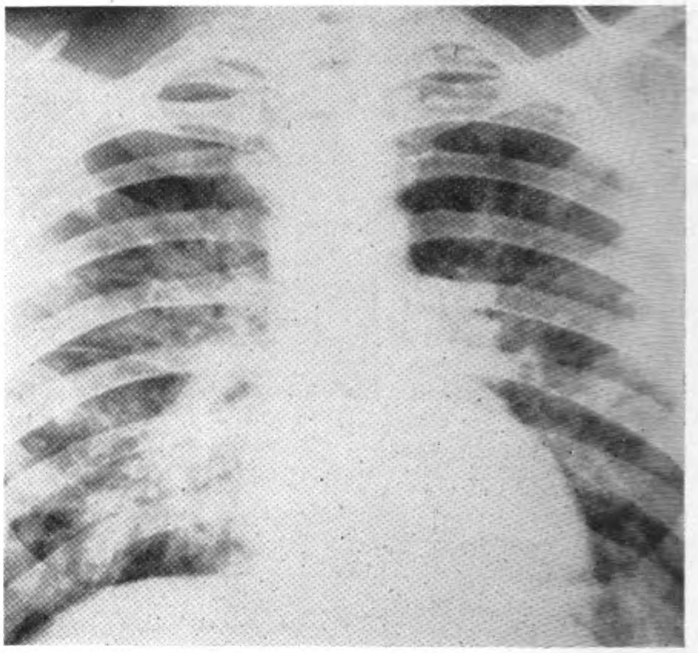

FIGURE 4. Case 4.

## CONCLUSION

These 40 cases are presented as variants from many of the descriptions of primary atypical pneumonia of unknown etiology. The disease appeared in epidemic form at a time when large numbers of cases of bronchopneumonia of unknown etiology were being seen. The roentgen picture showed consistent accentuation of hilar shadows, peribronchial infiltration, and a patchy, parenchymal infiltration frequently changing as to location, but quite generalized. No fatalities occurred and no complications other than persistent malaise and weakness.

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ASF, Headquarters Circular No. 217, 13 July 44 Part II, Sect. II

C.O.'s of general hospitals within U.S. to permit convalescent officers and enlisted men to leave hospital on temporary duty for purpose of assisting orientation officers at posts, camps, and stations, provided patient desires such duty and proposed absence from hospital (not to exceed thirty days) will not interfere with treatment or extend beyond convalescent period.

# Application and Processing of Acrylic Jackets

CAPTAIN IRVING ROSENFELD
Dental Corps, Army of the United States

Eight years ago the methyl methacrylates were introduced as denture material to the dental profession. Skepticism ran high. The thought of most dentists at that time was to have the other fellow do the experimental work. Today, acrylic is paramount as a denture material. The different phases of the processing of acrylic jackets can be learned and perfected only after much study. Naturally, the applied technique takes place in the laboratory. I will describe the methods which have proved most satisfactory in our work at the dental clinic at the Army Air Forces tactical center. The history of acrylic as found in the literature is rather meager. Experimental work goes back to 1901 when Dr. Otto Hohn did his original research in Germany. Acrylic plastics were first manufactured in this country in 1931 by the Rohn and Haas Company, Inc., for limited commercial use. Methyl methacrylate was placed on the market as a denture material in 1938.

Methyl methacrylate undergoes a complicated process in its manufacture. It is a crystal-clear, water-white liquid. Through the application of heat and the process of polymerization, which involves the linking of the monomer with the polymer to form larger molecules, the physical make-up of the product is changed. This alteration has changed a clear liquid into a solid which is crystal-clear.

This material has great strength. The water absorption is low and the surface is hard enough to offer high resistance without being brittle. Elasticity is good.

The Acrynamel outfit and technique are used exclusively and will be described to clarify the continuity of each step. The improvements are in the nature of the Dry Pack Technique to enhance its simplicity and produce more lifelike restorations, rather than in factory-made shades, hue, or intensity.

*Wax pattern.* Cavity preparations and dies are made in the conventional manner. The pattern is waxed with a good inlay wax, preferably one that is void of coloring. Carve all wax patterns with complete anatomy just as you want the finished jacket to look, including all grooves, depressions, and serrations. Overwax margins slightly and bead gingival portion to width of 1 to 2 mm. The need for the bead at the gingival

portion can well be understood if we keep in mind that methyl methacrylate shrinks slightly as polymerization progresses. This process does not take place simultaneously throughout the entire mass.

*Investment of pattern.* Remove pattern from die and invest in well-spatulated plaster of paris having a smooth, creamy texture. Paint investment on under surface (lingual) and inside of pattern, taking care to include all margins in first half of flask. Expose labial portion of pattern including as much as possible of mesial and distal portion without undercuts. Half of beaded gingival portion should be covered by investment in the first half of the flask.

*Counter-die and its preparation.* Allow to set, and paint separator over first half. Pour second half of flask, using well-spatulated plaster of paris. After second half of flask is hard, insert knife between halves and open the cold flask, as no undercuts should be in evidence in the top half of the flask. Remove wax completely by pouring over it boiling water. Do not stop in this process until all wax is removed. The dye in the wax has a tendency to stain the impression material and thus alter the final shade of the processed acrylic jacket. When flask can be held in the hand, flood mold with Film-Ac and allow to evaporate. This step is very important to ensure a clean inner and outer surface of the finished jacket. Again fill mold with Film-Ac and allow to stand for one-half minute. Shake out excess and allow to dry perfectly (five to ten minutes).

*Selection of shade.* Select gingival and incisal shades. A combination of two or more powders may be used in either case and then placed in the respective blending bottles and shaken thoroughly. Natural tooth colors to give lifelike naturalness is the work of the manufacturers. They have premixed gingival and incisal shades to match any shade guide. To produce the magic of color, we must bear in mind that tooth colors are fundamentally found in the opaque-type tooth and the translucent-type tooth. The opaque type, assimilating the 20th Century and Trubyte teeth, consists of two distinct shades, one for the incisal and one for the gingival. The translucent type is of one color—the gingival shade. This shade is brought to life by the addition of various proportions of transparent powder. Blending the shades takes practice and experience.

The proper shade obtained, and, with a working knowledge of colors and the proper technique in blending, we now strive to produce the desired shade. Place gingival powder into mold, shaking it down around the stump. Tilt flask if necessary to facilitate placement of powder. A thin layer of gingival powder should cover gingival portion and that part of tooth included in the blend. Place incisal shade in mold to form incisal portion and then sprinkle incisal shade lightly over gingival shade where blend is desired; then add monomer drop by drop to powders until completely saturated. The desired shade will practically come to life, for our blend has

already begun. We repeat the same procedure, placing incisal and gingival powders layer upon layer, remembering always to overlay the gingival with incisal color in incisal third much the same as enamel overlays dentine. This builds the jacket to proper height and width, continually keeps our blend throughout, and will maintain the desired blend on the facial regardless of whatever later adjustments may be necessary. Saturate powders with monomer and place wet cellophane over flask. Close both halves of flask, apply clamp, and close flask with steady, slow pressure. Open flask. Always sprinkle water over cellophane before removal. Mold should now be completely filled; otherwise, repeat, placing incisal and gingival powders as previously—layer upon layer. Wet exposed surface with monomer and then cover entire surface with layer of incisal. This completes the blend. Saturate with monomer, place wet cellophane over flask, and close both halves again. Open flask and check the pack as previously. Now, flood with monomer and then sprinkle lightly with transparent powder. Saturate powder again with monomer. Place another piece of wet cellophane over flask, and press tightly in clamp. The transparent powder is used as a final glaze over the entire facial surface of the restoration and also to increase the translucency of the jacket.

*Processing the restoration.* Process the case by starting with water at room temperature and allow at least one-half hour to come to a boil and at least one-half hour at a boil, but not more than one hour. Bench cool completely before opening flask. When time is a factor, bench cool for one-half hour and then place in hot water to equalize temperature of flask with the water. Gradually cool by adding cold water until flask is chilled. Separate the halves and remove the case. Sudden cooling causes contraction of the material.

*Finishing and polishing.* The plaster of paris will pick away from the jacket restoration cleanly leaving a glazed surface. Remove slight excess of parting line from mesial and distal portion of jacket by using sandpaper disk. The jacket is now ready to be polished, for it has previously been waxed to contour with all anatomical markings. A soft rag wheel with the old favorite laboratory stand-by—green marvel polish—is a perfect polishing medium. *Do not use pumice.* We already have a glazed surface with all anatomical carving. With a slow speed we need only polish the restoration. Any slight scratches that may remain help to form a more lifelike, natural restoration. With dull teeth in the mouth, leave a dull finish on the jacket, and with glossy teeth, allow a high luster. In no case, exert any pressure. Methyl methacrylate is a thermoplastic and undue pressure may generate frictional heat which may cause the surface to become gummy.

*Cementation* is a very important factor. Various shades of cement must be at hand. The use of a light shade with a light cement is as necessary as a dark cement for a dark shade.

Cement may first be mixed with water or, preferably, glycerin, and the restoration seated in position to ascertain the shade when permanently positioned. A slightly off-shade restoration may be perfectly corrected by the proper use of shaded cements.

Hundreds of cases have been completed with natural, life-like results. The same fundamental principles are applied in the processing of all acrylic bridges and acrylic inlays.

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# Suprapubic Cystotomy

MAJOR GEORGE C. PRATHER
Medical Corps, Army of the United States

General hospitals frequently receive patients who have had suprapubic cystotomy performed for wounds of the bladder, for rupture of the bladder associated with fracture of the pelvis, and for bladder drainage secondary to spinal cord injury. In some of these patients the suprapubic drainage is a temporary measure; in others a suprapubic catheter must be used for many months.

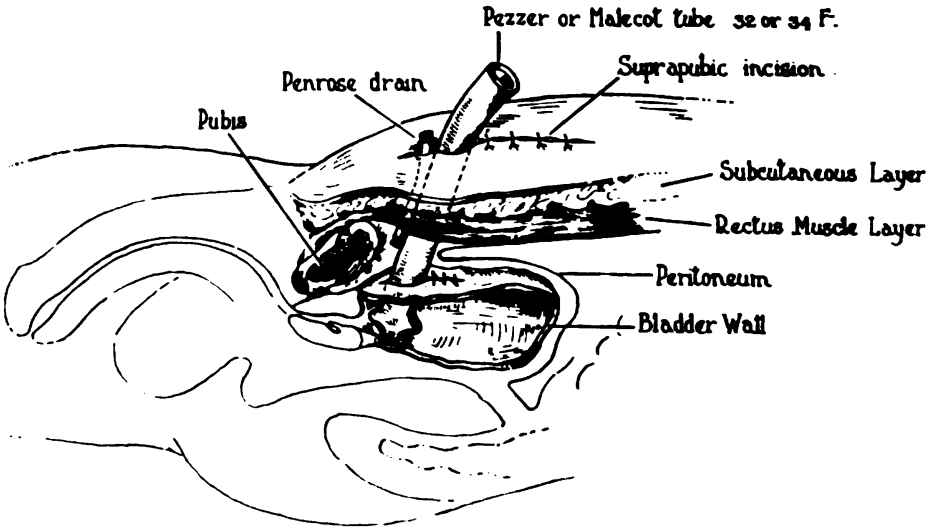


FIGURE 1. Sketch showing *unfavorable* placement of suprapubic tube in contact with trigone. The incision into the bladder has been made low on its anterior wall and the tube emerges from lower end of skin incision. The peritoneum has not been reflected adequately to permit easy and adequate exposure of interior of bladder should this be advisable at a later date.

In all cases where suprapubic cystotomy is deemed necessary, certain fundamentals are of both immediate and remote importance for the comfort and welfare of the patient.

Any foreign body, such as stone, catheter, or suprapubic tube, when in direct contact with the trigone of the bladder produces edema and is conducive to an inflammatory reaction, vesico-ureteral reflux, and ascending urinary infection. It is therefore advisable to place a suprapubic cystotomy tube in a manner which avoids contact with the trigone. This can be done if the tube is inserted through an opening in the dome or superior portion of the bladder and placed so it does not extend down to the region of the bladder neck. This desired position is shown in figure 2. The wrong position of the suprapubic catheter in the bladder is shown in figure 1.

At the time of the original closure of the bladder wall with a continuous chromic catgut suture snugly around the tube, it is preferable to have the mushroom part of the tube up against the anterior superior bladder wall rather than extending down over the trigone. This position of the tube also aids in keeping the wound watertight. To maintain the desired position of the tube

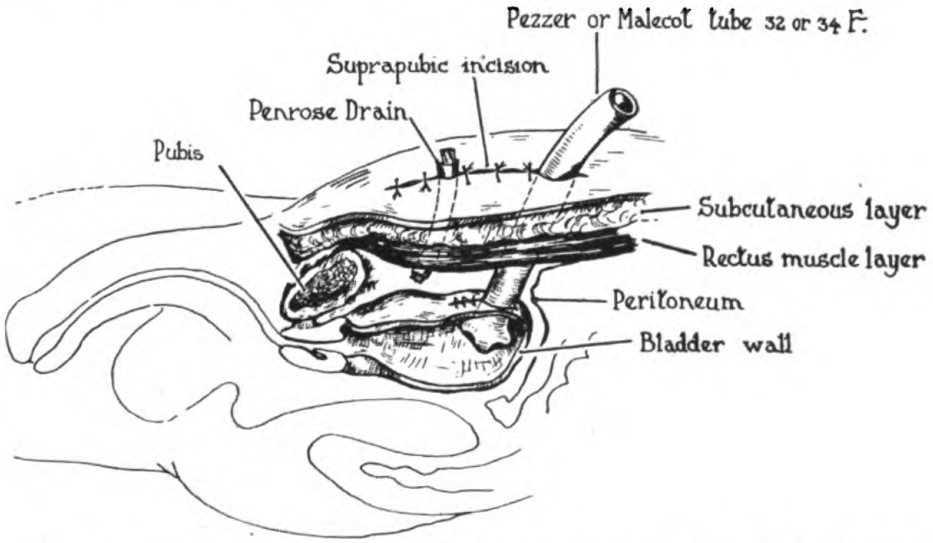


FIGURE 2. Sketch showing *favorable* placement of suprapubic tube in bladder cavity. Incision into bladder has been made high on its anterior superior surface with careful reflection of peritoneum. The suprapubic tube emerges from the upper end of bladder, fascial (not shown) and skin incisions. A Penrose or small cigarette wick drains the prevesical space.

in the bladder, as suggested, it is necessary to have the tube emerge at the upper end of the skin and fascial incisions. This position of the tube in relation to the incision has several advantages. An oblique sinus, rather than a short direct sinus, is formed. When eventual closure of the sinus is desired, healing will take place more readily. The oblique sinus does not increase the difficulty of changing suprapubic catheters when they become encrusted. In addition, the danger of periostitis of the pubis due to contact of the tube against the symphysis is avoided.

Of importance is the facility with which the bladder can be reopened for intravesical surgery when the cystotomy tube is brought out from the upper portion of the bladder and the upper end of the skin incision. Surgery of this type either before or after final closure of the wound is not uncommon for the removal of bladder stones and retrograde catheterization of traumatic strictures of the bulbous and membranous urethra. When cystotomy is performed as illustrated in figure 2, the full length of the skin incision can be utilized in reapproaching the bladder for a secondary operation and there is much less danger of opening the peritoneal cavity. An adequate exposure of the interior of the bladder is also facilitated.

If original closure is performed as in figure 1, it is difficult to obtain an adequate intravesical exposure without encountering peritoneum adherent to scar tissue.

The difficulties with suprapubic cystotomy can be diminished at the original operation by carefully reflecting the peritoneum upward to the uppermost portion of the badder and carefully placing the suprapubic tube at the upper end of the bladder and fascial and skin incisions.

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An insulated container of whole blood bound from England via air transport for battlefields in Normandy. Signal Corps photograph.

# The Enumeration of Malaria Parasites

ROBERT BRIGGS WATSON, M.D.

The number of malaria parasites in a unit volume of peripheral blood is of considerable importance in critical studies of malaria. Perhaps the greatest field of clinical usefulness of such information is in following changes in parasitemia produced by treatment; also, in *falciparum* disease, estimates of the degree of infection may determine the form of treatment employed.

Apparently Ross in 1903 made the first comprehensive investigations on the enumeration of malaria parasites. From his work and from studies by David Thompson in 1911 undertaken at the suggestion of Ross, the principles for two types of enumeration techniques were evolved. These may be called the "direct" and "indirect" methods. The principle of indirect enumeration was that used originally by Ross, who attempted to establish a ratio of leukocytes to parasites in dehemoglobinized thick blood films, the number of leukocytes per cu. mm. having been determined with a hemocytometer. In our experience, this method underestimates parasitemia as compared with the method described below.

Sinton in 1924 proposed an indirect enumeration procedure based on a method described by Dreyer in 1921 for counting bacteria and blood cells. In Sinton's technique, equal volumes of blood and a numerically standardized suspension of chicken cells are mixed. Thick films are prepared from the mixture and stained and the ratio of the number of fowl cells to the number of parasites is determined. Since the strength of the suspension of fowl cells is known, the number of parasites per cu. mm. of blood can be determined readily.

Probably the earliest method for direct counting of parasites employed the hemocytometer (Sinton 1924). This method did not give accurate results because the smaller parasites are difficult to distinguish even when the diluting fluid contains a stain such as gentian violet. The studies of Thompson in

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1911 developed a technique using a capillary pipette which delivered an exact amount of blood from which a square thick film was prepared. The thick film was dehemoglobinized and stained and the number of microscopic fields represented by the area of the thick film was estimated. The mean number of parasites per field was determined by counting three bands across the film and from this figure the parasite density per cubic millimeter was computed.

The method of Thompson was modified by Earle and Perez in 1932. Their modification consisted in using a pipette which delivered 5 cu. mm. instead of 1/8 cu. mm. delivered by Thompson's pipette. The blood was spread over an area 3 by 15 mm. To facilitate uniform spreading, an area of this size was drawn on paper and a slide placed over the drawing. Later the areas were actually marked on the glass slides by special diamond pointed markers which were devised by Mark F. Boyd of the Station for Malaria Research at Tallahassee. Boyd has been using this technique since 1934 with satisfactory results. Properly performed, the technique used by Boyd is probably the most accurate yet devised. But all techniques based on Thompson's method have the disadvantage that special equipment and more skill is required than is necessary for the usual hematological procedures. Special supplies and equipment are necessary also for Sinton's technique.

## TECHNIQUE

The following technique for the indirect enumeration of parasites in simian and human malaria infections has been used for several years at the University of Tennessee.

From a freely welling drop of blood obtained by finger puncture, a total leukocyte count is made in the usual manner. A thin blood film is made from the same drop of blood, care being taken to secure a uniform distribution of cells in the film. While the blood film may be spread satisfactorily with the edge of another glass slide, the edge of a hemocytometer cover glass is a better instrument. The film is allowed to dry, then stained with Wright's or Giemsa's stain.

The stained film is examined with a high-dry objective to select an area where the leukocytes and erythrocytes appear to be distributed most uniformly. Such an area is usually found about the center of the film. The oil immersion objective and 6X oculars, preferably wide-angle, are then used to count the parasites in this area. Examination of the film is begun at one edge and the slide is traversed from side to side, the examination always including each edge. When an excursion has been completed, the slide is shifted vertically one microscopic field. Each leukocyte and each parasitized erythrocyte is tallied until 200 leukocytes or, alternatively, 200 parasitized erythrocytes have been counted, which-

ever number is reached first. From these data the number of parasites per cubic millimeter of blood can be calculated easily since the number of leukocytes per cubic millimeter of blood is known.

Example:

| No. WBC Counted | : | WBC/cu. mm. | : : | No. Para. Counted | : | Para./cu. mm. |
|---|---|---|---|---|---|---|
| 200 | : | 5,000 | : : | 100 | : | X |
| | | 200X | = | 500,000 | | |
| | | X | = | 2,500 | | |

It is desirable to count 200 leukocytes or 200 parasitized erythrocytes in an effort to lend stability to the values obtained. However, there is a tendency toward leukopenia in malaria infections, and when this is accompanied by a low parasite density the counting of 200 cells may be time consuming. Consequently, when many counts have to be done and technical personnel is limited, it may be necessary to fix a lower limit for the number of cells to be counted. It is not recommended, however, that this number be less than 100.

No claim is made that the values obtained by this technique represent precise enumeration of parasites. There are several sources of error, notably the efficiency of technicians in making blood films, in selecting the areas for counts, and in making the counts. It is desirable for the same technician to make all of a series of determinations in an effort to keep the factor of error consistent.

## ADVANTAGES

The advantages of the method are that the supplies required are usually found in any laboratory performing the simplest hematological studies; and that the technique is so simple that any technician can learn to perform it quickly and with a minimum of supervision. The results obtained, while approximate, permit a reasonably satisfactory numerical expression of changes in parasitemia.

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# Jaundice in Infectious Mononucleosis

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Filatow in Russia recorded in 1855 the first instance of this disease. In 1899, Pfeiffer, who established it as a clinical entity and called it glandular fever, mentioned the occurrence of hepatomegaly in the course of the disease.[1] West, who reported the first cases in America in 1896, was the first to mention muddy skin as part of the picture.[2] In 1920 Sprunt and Evans[3] suggested that the term infectious mononucleosis be used; however, not until the report of Mackey and Wakefield[4] in 1926 was jaundice definitely recognized as a part of the picture of infectious mononucleosis. Their patient had obstructive jaundice with hepatomegaly which persisted for two weeks. They ascribed the jaundice to enlarged abdominal lymph nodes occluding the common duct. Schmidheiny[5] described 4 cases of icterus occurring with a lymphocytic blood picture characteristic of infectious mononucleosis. Three of these had glandular enlargement; one, in addition, had hepatomegaly. The 4th, originally presented by Naegele in 1915, as a case with a peculiar blood reaction, developed glandular enlargement subsequent to the onset of jaundice. In 1928, Chevallier[6] pointed out that icterus may occur with or precede adenopathy, or may constitute the only symptom in infectious mononucleosis. This was illustrated by cases presented by Snapper, Rykins, and Teriven,[7] and Spittuler and Teriven.[8] In 1932 Paul and Bunnell[9] in their original description of the heterophile antibody reaction presented one case of jaundice in which this reaction was positive. From available clinical reports, De Vries[10] clarified what Chevallier had previously pointed out. He classified the types of jaundice occurring in this disease as follows: (1) jaundice as the first symptom followed subsequently by glandular enlargement; (2) jaundice appearing along with glandular enlargement; (3) jaundice, with or without fever, occurring as the only symptom. The blood picture and heterophile antibody reaction justify the diagnosis of glandular fever. This type is a rare form. As mentioned before, Schmidheiny was the first to recognize such a case. Lehndorff,[11]

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10. De Vries, S. I.: Acta med. scand., 95:552, 1938.
11. Lehndorff, quoted by De Vries.10

on the other hand, considered such a diagnosis unjustifiable in view of the atypical clinical signs. Chevallier believes that cases of this type probably occur. The argument was settled by the presentation of 3 cases of this type in children by De Vries. Two, however, developed glandular enlargement after the jaundice disappeared.

Among 33 cases of glandular fever presented by Nyfeldt,[12] 4 had icterus. McKinlay[13] mentioned 5 occurrences of jaundice among 55 cases of infectious mononucleosis. Chapman and Chapman[14] reported 7 cases occurring in the course of an epidemic of glandular fever. Heterophile antibody tests were not done, but the blood picture was considered characteristic. It occurred two times in 28 cases reported by Stuart et al.[15] and only once in Bernstein's[16] 65 cases, and Leavell and McNeel's[17] 50 cases. Among 39 cases of infectious mononucleosis seen at the Bronx Hospital from 1934 to 1 March 1942 jaundice occurred five times between 1939-1942. A partial survey of the literature indicates that only about 35 cases of infectious mononucleosis with jaundice have been reported. The following 5 cases are reported as examples of the various forms described by De Vries.

## CASE REPORTS

CASE 1. A 22-year-old white male was admitted to the ward service on 17 June 1941, complaining of jaundice since 9 June. On 7 June the patient noted a feeling of slight malaise and epigastric distress. These symptoms were accompanied by transient nausea but no vomiting. The nausea persisted until 9 June, when the patient was noted to have an icteric tint to the skin, nail beds, and sclerae. Epigastric fullness returned and was accompanied by slight pain in the right upper quadrant. Clay-colored stools and dark urine, together with a mild temperature rise to an average of 99.5° F. were noted. This condition persisted unchanged until admission except for the occurrence of vomiting one time on 16 June. There was no constipation, diarrhea, or mucus, pus, or blood in the stools. The past history was not contributory.

On admission the patient was not acutely ill. His temperature was 99° F., pulse 60, and blood pressure 122/72. The skin and sclerae were moderately icteric. There was slight injection of the pharynx. Bilateral discrete non-tender enlargement of the postauricular, axillary, inguinal, and the left supraclavicular nodes was present. A systolic murmur was heard at the apex of the heart. The liver was enlarged almost to the umbilicus, slightly tender, and smooth. The spleen was enlarged and non-tender. The diagnosis, prior to the result of the laboratory studies, was (1) infectious mononucleosis, (2) malignant lymphoma, and (3) acute catarrhal jaundice.

The urine was normal. Blood studies showed hemoglobin 94 percent (Sahli), red blood cells 4.6 million, white blood cells 23,500, with a differential of 10 percent polymorphonuclear leukocytes, 3 percent band forms, 35

12. Nyfeldt, A.: Fol. haemat., Lpz., 47:1, 1932.
13. McKinlay, C. A.: J. A. M. A., 105:761, 1935.
14. Chapman, A. A., and Chapman, J. A.: Southwest. M., 24:200, June 1940.
15. Stuart, C. A., et al.: Arch. Int. M., 54:199, 1934.
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percent lymphocytes, and 52 percent monocytes. Roentgenological examination of the chest revealed a normal heart and lungs.

The presence of a leukocytosis and monocytosis suggested infectious mononucleosis as the disease responsible for the patient's symptoms. This was confirmed by the presence of a positive heterophile antibody test. The jaundice was found to be hepatogenous nonobstructive in character. Blood cholesterol studies and liver function tests revealed the liver to be damaged. The temperature and pulse were normal throughout. The jaundice cleared by the eighth day of hospitalization, 25 June. At the time of discharge, 27 June, the glands were just palpable, the tip of the spleen was still felt, liver function had returned completely to normal, and monocytosis was still present. (See tabulation of laboratory studies.)

## Comment

The clinical picture simulated that seen in acute catarrhal jaundice except for the generalized lymph node enlargement found on physical examination upon admission. The physical findings were clarified by the blood studies which revealed a mild nonobstructive toxic jaundice as part of the picture of infectious mononucleosis. Within three weeks of the onset, the patient was entirely well except for the persistence of a monocytosis. This case falls into a type 1 of De Vries; namely, jaundice as the first symptom followed by glandular enlargement.

CASE 1

| Date | 18 June | 19 June | 21 June | 23 June | 24 June | 26 June | 27 June |
|---|---|---|---|---|---|---|---|
| Erythrocytes (millions) | 4.6 | | 5.39 | | 5.36 | | |
| Hemoglobin % (Sahli) | 94 | | 104 | | 100 | | |
| Leukocytes | 23,500 | | 10,100 | | 9,100 | | |
| Polymorphonuclears | 10 | | 11 | | 25 | | |
| Band forms | 3 | | 1 | | 2 | | |
| Lymphocytes | 35 | | 74 | | 55 | | |
| Monocytes | 52 | | 14 | | 18 | | |
| Platelets | | 150,000 | | | | | |
| Bleeding time—min. | 2 | | | | | | |
| Coag. time—min. | 6½ | | | | | | |
| Heterophile antibody titer high. pos. dil. | | 1:128 | | | 1:32 | | |
| Icteric index | 17.6 | | | | | | |
| Van den Bergh | Direct immed. | | | | | | |
| Serum bilirubin units/100 cc. serum | 1 | | | | | | |
| Chemistry Urea nitrogen | | | | | 12 | | |
| Uric acid | | | | | 3.6 | | |
| Cholesterol mg. % | | | | | 219.9 | | |
| Cholesterol esters mg. % | | | | | (30%) 79.9 | | |
| Hippuric acid excretion—gm. | | | | 1.7 | | | 3.88 |
| Urine Bile | Neg. | | | | | | |
| Urobil high. pos. dil. | 1:150 | | | | | 1:10 | |
| Wassermann | Neg. | | | | | | |

CASE 2. A 28-year-old white female was admitted to the private medical service of Dr. L. H. Schultz on 7 June 1939, because of fever and headache of eight days' duration. Ten days before admission, the patient felt ill and anorectic. Two days later she complained of chills and a stiff neck and felt an enlarged cervical node which was tender. Her temperature was 102° F. and the next day rose to 105° F. and thereafter was spiking in character, rising to 102° and 103° F. From 1 June, she felt nauseated. Vomiting started on 3 June and was associated with epigastric pain and constipation from 5 June. The day before admission friends noticed a yellowish tinge of her eyes and skin.

On admission the patient appeared acutely ill. Her temperature was 100.8° F., pulse rate 94, and the blood pressure 110/80. The sclerae were jaundiced, and there was mild icterus on the remainder of the body. The other significant findings were a red throat, large tender posterior cervical nodes bilaterally, mostly on the right, and a few enlarged nodes in the right axilla. There was tenderness in the epigastrium and right upper quadrant. The liver was questionably felt at the costal margin and the spleen

was palpable. Before the return of the laboratory data, the admission diagnosis was acute catarrhal jaundice with the possibility of infectious mononucleosis as the cause.

The initial urine specimen was lost. The icteric index was 30.5, and the Van den Bergh reaction immediate direct with 2.6 units of serum bilirubin per 100 cc. of blood. The blood culture was sterile after 144 hours' incubation. The blood serum did not agglutinate the typhoid-paratyphoid group or *B. proteus* X-19.

The laboratory findings indicated a mild hepatogenous nonobstructive jaundice. The day after admission the true nature of the condition was revealed by the high mononuclear cell count in the blood and positive Paul-Bunnell test. The temperature ranged between 99.2° and 102° F. during the first week and thereafter remained normal except for a rise to 101° F. on the tenth day, 17 June, due to a pharyngitis which subsided rapidly. Nausea disappeared the day following admission. The liver became distinctly palpable on the third hospital day. On the fourth hospital day, 11 June, an itchy rash appeared. The jaundice cleared rapidly, and the glands receded in size. When the patient was discharged from the hospital on 21 June, the fourteenth hospital day, there was no icterus and the glands were barely palpable. (See tabulation of laboratory studies.)

CASE 2

| Date | 8 June | 9 June | 16 June |
|---|---|---|---|
| Hemoglobin % (Sahli) | | 84 (12.2 gm.) | 86 (12.6 gm.) |
| Erythrocytes (millions) | | 3.96 | 4.43 |
| Leukocytes | | 11,600 | 14,000 |
| Polymorphonuclears | | 6 | 29 |
| Band forms | | 8 | |
| Lymphocytes | | 66 | 51 |
| Monocytes | | 8 | 20 |
| Atyp. lymphocytes | | 11 | |
| Basophiles | | 1 | |
| Icteric index | 30.5 | | 27.8 |
| Serum bilirubin units/100 cc. serum | 2.6 u. | | |
| Van den Bergh | Dir. immed. | | |
| Heterophile antibody titer highest complete agglutination | 1/128 | | |
| Blood culture | Neg. | | |
| Agglutination with typh.-paratyph. group | No | | |
| *B. Proteus* X-19 | No | | |
| Urine—routine | Neg. | | |

## Comment

The onset with chills, fever, and enlarged tender nodes was suggestive of a respiratory infection; however, the subsequent development of gastric symptoms and the jaundice was indicative of a hepatitis or an acute catarrhal jaundice. The enlarged lymph nodes and the blood studies indicated a mild toxic jaundice as part of the picture of glandular fever. The condition cleared rapidly. Three weeks after the onset, the patient was entirely well, though the blood still showed a mononucleosis. The case falls into type 2 of De Vries, namely, glandular enlargement and jaundice occurring together.

CASE 3. A 28-year-old white female was admitted on 2 August 1939 to the private medical service of Dr. D. M. Watman because of weakness and headache of five days' duration. On the evening of 28 July, the patient was taken with a severe headache and general malaise. She felt weak and warm. The symptoms continued until the morning of 30 July when, while

moving her bowels, she developed severe cramp-like abdominal pain, associated with extreme faintness and nausea. The symptoms disappeared in a short time. Since then weakness and headache with occasional nausea have persisted.

On admission to the hospital, physical examination revealed an acutely ill patient. The temperature was 103.4° F., pulse 88, and blood pressure 98/64. The significant findings were bilateral enlargement of the posterior cervical glands, a palpable tender spleen, and right costovertebral tenderness. Dr. Watman's impression, prior to the laboratory examination, was la grippe.

CASE 3

| Date | 2 Aug. | 4 Aug. | 7 Aug. | 8 Aug. | 11 Aug. |
|---|---|---|---|---|---|
| Hemoglobin % (Sahli) | 74% (10.7 gm.) | | | | 86% |
| Erythrocytes (millions) | 3.74 | | | | 4.2 |
| Leukocytes | 4.700 | | | | 8.700 |
| Polymorphonuclears | 28 | | | | 19 |
| Band forms | 7 | | | | 1 |
| Small lymphocytes | 46 | | | | 70 |
| Monocytes | 19 | | | | 9 |
| Eosinophiles | | | | | 1 |
| Icteric index | | | | 20.7 | |
| Serum bil. units per 100 cc. serum | | | | 1.6 | |
| Van den Bergh | | | | Bi-phasic | |
| Heterophile antibody reaction | | 1:8 | 1:8 | | |
| Urine<br>Urobil. high. pos. dil. | | | 1:100 | | |
| Blood culture | Sterile | | | | |

The following day, 3 August, the laboratory reported the urine normal; the hemoglobin (Sahli) 74 percent; erythrocytes, 3,700,000; leukocytes, 4,700 with 28 neutrophiles, 7 band forms, 46 small lymphocytes, and 19 monocytes. Blood culture was sterile. Either typhoid fever or infectious mononucleosis was now considered the most likely diagnosis. The temperature fell by lysis to normal by the sixth day, 8 August, and remained so until discharge. During the period of elevated temperature the pulse ranged between 80 and 90 and thereafter around 80 beats per minute. By the third day, 4 August, the increase in the size of the cervical glands and the fall in the temperature were more in favor of infectious mononucleosis as the cause of the patient's symptoms, this in spite of two negative heterophile antibody tests. Dr. M. Weiss saw the patient in consultation on 6 August. He found a few enlarged glands in the anterior and posterior triangles and supraclavicular area and a red throat. He corroborated the diagnosis of glandular fever. On the seventh day of hospitalization the patient was definitely jaundiced. The liver was tender and enlarged two to three fingers below the costal margin. No spleen was felt. The cervical nodes were still enlarged and tender. The patient had no complaints. The jaundice was determined to be nonobstructive in character. The next day, the spleen was palpable for the first time, and a diffuse sudaminal rash was present. There were still no complaints. On 11 August, the eleventh day, the spleen was larger, but the liver was smaller and only slightly tender. On the day of discharge, 12 August, the patient was still slightly icteric, the liver was enlarged one finger below the costal margin, the spleen was barely palpable, and the cervical nodes were remarkably diminished in size. (See table for blood studies.)

### Comment

The initial clinical picture suggested a diagnosis of la grippe to the patient's physician. In the hospital the finding of an enlarged spleen, relative bradycardia, and leukopenia with a relative lymphocytosis was indicative of typhoid fever. The presence of cervical adenopathy and a high mononuclear cell count on the blood smear, however, was in favor of infectious mononucleosis. The latter diagnosis was substantiated by the subsequent clinical course and laboratory findings irrespective of the absence of a positive heterophile antibody test. Five days after admission and nine days from the onset of her illness, jaundice and hepatomegaly developed. The laboratory findings were indicative of a toxic hepatitis as the cause of the jaundice. Since no other cause for the icterus was found, the hepatitis was considered to be part of the picture of infectious mononucleosis. On the eighth day of hospitalization, the thirteenth day of illness, a diffuse sudaminal rash developed. Rashes are common in infectious mononucleosis. By the time of discharge, the thirteenth day, the jaundice had almost completely disappeared; the liver, spleen, and cervical nodes were remarkably diminished in size; and the blood still showed a marked lymphocytosis. This case falls into the second category of De Vries, namely, jaundice appearing along with glandular enlargement.

CASE 4. A 20-year-old white male was admitted to the ward service on 24 June 1940. Two and one-half weeks prior to admission, the patient complained of feverishness, sore throat, and chills. His temperature was found to be elevated and had ranged between 100-103° F. up to the time of his hospitalization. His family physician placed him on medication, the nature of which he did not know. Two days later the soreness in his throat disappeared. Thereafter, anorexia and frequent belching were his only complaints. Two days before he entered the hospital, his skin became yellow and pain on swallowing returned. Consequently all medication was discontinued by his physician.

On admission the patient looked acutely ill. His temperature was 102.8° F., pulse 116, and respirations 28 per minute. The skin and mucous membranes were markedly icteric. The tonsils were follicular and the pharynx markedly injected. Small shotty cervical nodes, enlarged submaxillary nodes bilaterally, and an enlarged right occipital node were present. Abdominal tenderness and rigidity were absent. The liver and spleen were 1½ and 2 fingers respectively below the costal margin. Prior to the report of the laboratory studies, the diagnosis was (1) lymphoblastic acute leukemia, (2) infectious mononucleosis, and (3) toxic hepatitis.

The urine had a deep yellowish foam and contained an occasional red and 2 or 3 white blood cells per high-power field microscopically. A complete blood count showed 110 percent (Sahli) hemoglobin, 5.1 million red and 28,900 white blood cells with a differential of 15 polymorphonuclear leukocytes, 2 band forms, 78 lymphocytes, 4 monocytes, and 1 lymphoblast per 100 white cells. *Streptococcus hemolyticus* and *Staphylococcus albus* were the only organisms present on a throat culture. Wassermann and Kahn tests were negative.

As a result of the admission blood studies a diagnosis of infectious mononucleosis was made. On the second day of hospitalization, this was

confirmed by the positive Paul-Bunnell reaction. The jaundice was hepatogenous nonobstructive in type and part of the disease picture. The liver was undamaged as shown by the blood chemistry and liver function studies. The temperature fell to normal by the sixth day, 30 July, and remained so until discharge. The jaundice was gone by the thirteenth day. On this day, 5 August, the patient was well enough to be discharged, though the liver and spleen were still palpable and the mononucleosis persisted. (See tabulation of laboratory studies.)

CASE 4

| Date | 24 July | 25 July | 29 July a. m. | 29 July p. m. | 5 August |
|---|---|---|---|---|---|
| Erythrocytes (millions) | 5.1 | | 5.5 | 4.96 | 4.64 |
| Hemoglobin % (Sahli) | 110 | | 110 | 108 | 106 |
| Leukocytes | 28,900 | 25,300 | 19,300 | 16,500 | 13,800 |
| Polymorphonuclears | 15 | 17 | 5 | 15 | 15 |
| Band forms | 3 | 4 | 5 | 7 | |
| Small lymphocytes | 78 | 76 | 89 | 73 | 79 |
| Monocytes | 4 | | 4 | 4 | 3 |
| Lymphoblast | 1 | | | | |
| Young forms | | 1 | | | |
| Eosinophiles | | 1 | | | |
| Hematocrit cc. packed erythrocytes per 100 cc. blood | 47 | | | | |
| Fragility of erythrocytes | | 0.40–0.26% | | | |
| Platelets | | 160,000 | | | |
| Bleeding time—minutes | | 1 | | | |
| Coag. time—minutes | | 4 | | | |
| Sed. rate (Wintrobe) mm. at end of 1 hour | | 38 | | | |
| Blood culture | | Sterile | | | |
| Heterophile antibody titer High. comp. aggl. | | 1:32 | 1:64 | | |
| Partial aggl. | | 1:128 | | | |
| Wassermann and Kahn | | Neg. | | | |
| Icteric index | 46 | | | | 16.8 |
| Serum billirubin units/100 cc. | 4 | | | | 1 |
| Van den Bergh | Dir. bum. | | | | Biphasic |
| Chemistry Glucose | | 87.8 | | | |
| Urea nitrogen | | 15.4 | | | |
| Uric acid | | 4.0 | | | |
| Creatinine | | 1.37 | | | |
| Cholesterol mg. % | | 153 | | | |
| Cholesterol ester mg. % | | 83 | | | |
| Sulfanilamide conc. mg. % | | 6.6 | | | |
| Prothrombin time (Smith) | | 80% | | | |
| Hippuric acid synthesis | | | 3.14 | | |
| Stool Bile | | Neg. | | | |
| Fat digestion | | Good | | | |
| Urine Bile | | Pos. | | | |
| Urobil. high. pos. dil. | | 1:175 | | | |
| Microscopic | | Occult rbc. wbc. | Occult wbc. | | |
| Throat culture | No diph. Staph. albus Str. hemol. | | | | |

## Comment

The onset was typical of an upper respiratory infection. For the persistently elevated temperature sulfanilamide was given. When jaundice developed after mild gastric symptoms, the ingestion of the drug was discontinued. (The total amount of drug taken was unknown.) A small amount of the sulfanilamide was found in the blood after admission to the hospital. Though on rare occasions sulfanilamide can cause a toxic hepatitis with jaundice, I feel that the icterus was part of the picture of infectious mononucleosis. This diagnosis was proved by the presence of a marked leukocytosis and monocytosis and a positive heterophile antibody reaction. The jaundice was hepatogenous, toxic in nature, and moderately severe. Blood chemistry and liver function studies revealed an undamaged liver. The temperature fell to normal by the sixth day, 30 July, and remained unchanged until discharge. The icterus disappeared by the thirteenth day. On this day, 5 August, the patient was discharged as well, though the liver and spleen were still palpable and monocytosis persisted. This case falls into type 2 of De Vries, namely, jaundice and glandular enlargement occurring together.

CASE 5. A 21-year-old white female was admitted to the ward service of Dr. S. Sobel on 25 September 1940. Two weeks prior to admission she had the onset of headaches, pains in the limbs, and a temperature of 101° F. Her local physician treated her without relief. Four days before admission, she felt nauseated and vomited once. Associated with the latter symptoms were chills and epigastric pain. Three days before admission jaundice was first noted. This increased in severity and was associated with persistence of the nausea and vomiting of all food eaten, together with continuance of the epigastric pain and distress. No medication was taken.

On admission, the physical examination revealed a markedly icteric (skin and sclerae), well-developed, white patient. The temperature was 101.8° F., pulse 130, and respirations 24 per minute. Blood pressure was 130/82. The only other abnormal findings were a slight pharyngeal con-

gestion and a spleen palpable one finger's breadth below the costal margin. Prior to the results of the laboratory findings, the diagnosis was jaundice etiology: (1) infectious; (2) Weil's disease; (3) infectious mononucleosis; (4) hemolytic anemia.

The urine was dark and showed an occasional hyalin cast microscopically. A blood study revealed 2,830,000 erythrocytes with 67 percent (Sahli) hemoglobin, and a white cell count of 16,900 with 26 neutrophiles, 11 band forms, 27 small lymphocytes, 23 large lymphocytes, and 1 Turck cell per 100 cells. The first five days of hospitalization, the temperature ranged between 99.4° and 102° F. Thereafter it gradually fell by lysis to normal by the thirteenth hospital day, 8 October, and remained so until discharge on 10 October.

CASE 5

| Date | 25 Sept. | 26 Sept. | 27 Sept. | 30 Sept. | 1 Oct. | 5 Oct. | 7 Oct. | 10 Oct. |
|---|---|---|---|---|---|---|---|---|
| Erythrocytes (millions) | 2.83 | | | 3.22 | | 3.66 | | 3.77 |
| Hemoglobin % (Sahli) | 67 | | | 62 | | 72 | | 74 |
| Leukocytes | 16,900 | | | 12,100 | | 8,000 | | 8,600 |
| Polymorphonuclears | 26 | | | 23 | | 34 | | 48 |
| Band forms | 11 | | | 3 | | 5 | | 6 |
| Small lymph. | 27 | | | 62 | | 42 | | 31 |
| Large lymph. | 23 | | | | | | | |
| Monocytes | 12 | | | 11 | | 15 | | 13 |
| Eosinophiles | | | | 1 | | 2 | | |
| Young forms | | | | | | 1 | | |
| Turck cell | 1 | | | | | | | |
| Basophile | | | | | | 1 | | 2 |
| Fragility of erythrocytes | | 0.40 to 0.36 | | | | | | |
| Reticulocytes % | | 0.8 | | | | | | |
| Platelets | | 260,000 | | | | | | |
| Icteric index | | 74.3 | | | 55 | | 16.6 | |
| Serum bilirubin | | 7.0 | | | | | 1.4 | |
| Van den Bergh | | Immed. dir. | | | | | Biphasic | |
| Chemistry Glucose | | 94.0 | | | | | | |
| Urea nitrogen | | 13.4 | | | | | | |
| Uric acid | | 3.4 | | | | | | |
| Creatinine | | 1.29 | | | | | | |
| Guinea-pig inoculation after 10 days | | | | No evidence of infect. jaundice | | | | |
| Hippuric acid excretion gm. | | | | 2.56 | | | | |
| Agglutination *B. Proteus* X19 | | | | | Partially 1.40 | | | |
| Heterophile antibody titer, highest positive dilution | | 1.512 | | | | | | |
| Wassermann and Kahn | | Neg. | | | | | | |
| Prothrombin time (Smith) | | 100% | | | | | | |
| Stool Bile | | | Neg. | | Neg. | | | |
| Hydrobilirubin | | | | | | Present | | |
| Urine Color | Dark | | | Dk. bwn. | | Cl. dark | | |
| Bile | | Str. pos. | | | Neg. | | Neg. | |
| Urobil. high. pos. dil. | Occ. hyal. cast | 1:100 | 1:40 | | 1:50 | | 1:75 | |
| Microscopic | | | | Neg. | | Neg. | | |
| Clot. retr. hr. | | 4 | | | | | | |
| Rumpel-Leede | | | Neg. | | | | | |

Studies were undertaken to determine the cause of the jaundice. The jaundice was found to be hepatogenous nonobstructive in character. On 30 September a hippuric acid excretion test showed mild liver damage. Blood studies revealed no evidence that hemolysis of the red cells was the cause of the icterus. Guinea-pig inoculation ruled out Weil's disease. The positive heterophile antibody titer in a dilution of 1:512, in conjunction with the high admission mononuclear cell count and splenomegaly, favored the diagnosis of infectious mononucleosis in spite of the absence of lymphadenopathy. Repeated blood counts showed a rise in red blood cells and hemo-

globin, a fall in the total white cells to normal, a rise in the polymorphonuclear cells, and a fall in the mononuclear cells. The latter still persisted above the normal level by the time of discharge. The jaundice diminished rapidly in about a week and was gone by the time the patient left the hospital. On the fifth hospital day, 30 September, a generalized pruritic maculopapular eruption appeared on the patient's body, associated with stuffiness in the ear and throat. The eruption cleared in a few days and again reappeared on 6 October. The spleen was not felt after 1 October. The patient was discharged well on the fifteenth hospital day, 10 October. (See tabulation of laboratory studies.)

Comment

The prodromal period lasted eleven days before jaundice appeared. A diagnostic problem was involved, because the physical signs were wanting aside from fever, jaundice, and splenomegaly. The absence of drug ingestion ruled out a toxic hepatitis with jaundice. The admission blood study showed a high mononuclear white cell count, suspicious of infectious mononucleosis, and a moderately severe anemia. Further laboratory studies ruled out hemolytic anemia and Weil's disease as factors and implicated infectious mononucleosis as the responsible agent for the hepatogenous toxic jaundice. The unusual features in this case were a prolonged prodromal period, eleven days; jaundice without the presence of an enlarged liver, though hepatic function was diminished; the absence of adenopathy and the presence of splenomegaly and fever. This case, therefore, falls into the rare third category of De Vries, namely, "forme icterique pure with fever."

## DISCUSSION

The prodromal symptoms preceding the onset of jaundice are characteristic of those preceding an acute hepatitis, namely, anorexia, nausea, at times vomiting, epigastric or right upper quadrant pain or distress, or both. To the full-blown clinical picture are added jaundice, enlarged tender liver (in mild cases there may be no enlargement), hyperbilirubinemia, urobilinuria, biluria, and decreased hepatic function. Laboratory studies show an icteric index which may rise to as high as fifty units of serum bilirubin and 8 mg. percent. The Van den Bergh may be direct, direct delayed (indirect), or biphasic. Hepatic function may be impaired. The hepatitis may last from two to twenty-one days. In 50 to 80 percent of the cases the heterophile antibody reaction is positive.[17]

Since no postmortem studies have been performed, it is difficult to ascribe an exact cause for the jaundice.

The clinical course of glandular fever is indicative of an infectious origin. Animal experiments suggest that a filtrable virus may be the causative factor.[18] [19] That this is probably lymphocytic in character is based on the fact that in both epidemic and sporadic forms of this disease, hematological changes, notably an absolute and relative increase of the mononuclear cells, have always been recognized as characteristics suggesting an irrita-

18. Wesing, J. P., quoted by R. R. Kracke: Texas J. M., 36:348, 1940.
19. Nettleship, A., quoted by Karsner, H. T.: Textbook of Pathology, 6th ed., p. 435. Philadelphia: J. B. Lippincott and Co., 1942.

tion of lymphatic tissue. (This is also found in those diseases such as measles, in which the virus is known.) The jaundice most likely is infectious in origin. Whether the supposed organism acts mechanically by enlargement of the lymph nodes which press on the bile duct or directly on the liver has not been settled. The protagonists of the former idea base their theory on the fact that in this disease it is known that intra-abdominal lymph nodes may enlarge and may precede external node swelling. Since their patient had severe abdominal pain, Mackey and Wakefield[4] ascribed the obstructive jaundice to enlarged abdominal nodes obstructing the common bile duct. Anatomically this could

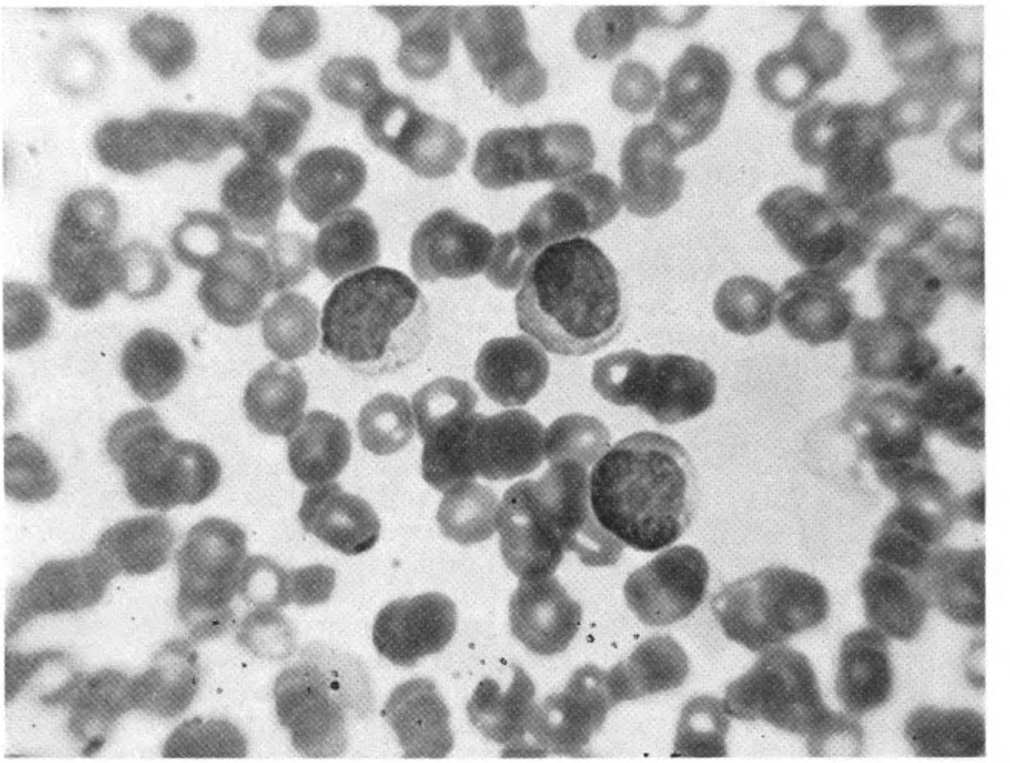

FIGURE 1. Blood film showing three cells of the typical abnormal lymphocyte type encountered in infectious mononucleosis.*

only occur in Calot's triangle. To De Vries,[10] the abdominal pain in one of his cases suggested that enlargement of the lymph nodes about the hilum of the liver may have been the factor causing the jaundice. The protagonists of the second theory feel that a hepatitis is responsible for the icterus.

I feel that the hepatitis is definitely a part of the picture of infectious mononucleosis. The etiological agent or its toxin probably attacks some portion of the liver *per se*. The liver parenchyma itself may be directly affected, or conceivably the lymphatic tissue in the portal canals becomes hyperplastic or both.

*Figures 1 and 2 bear no direct relation, as far as known, to the cases reported by the author. They were selected as illustrations from the files of the Museum and Medical Arts Service, reference number B-435.

In the former case, damage to the liver cells may interfere with the passage of bile along the bile capillaries or result in failure to excrete freely bile pigment formed extrahepatically or both in varying degrees. In the latter case, the hyperplastic lymphatic tissue would compress the surrounding bile ducts. Bile congestion would interfere with the free passage of bile from the liver cells. This congestion would probably cause liver cell degeneration. In the presence of cell degeneration, the free egress of bile formed extrahepatically would be prevented. Liver cell damage alone or with an associated obstruction of the bile ducts would result in hepatomegaly with jaundice.

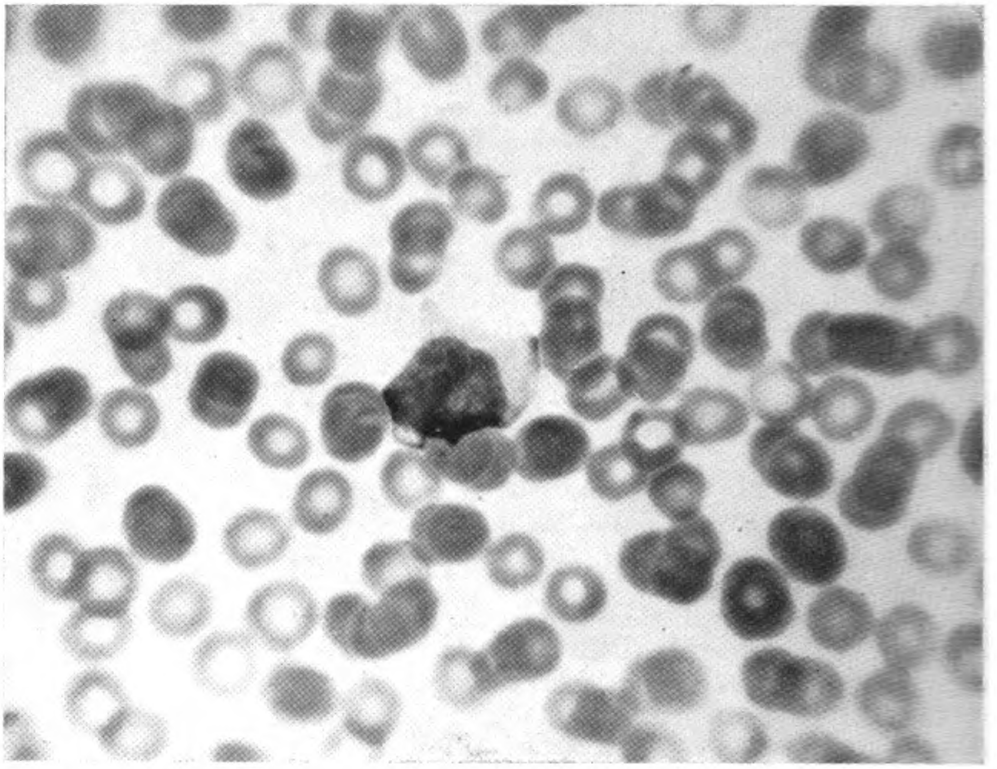

FIGURE 2. "Old" lymphocyte with pallid cytoplasm and frayed edges, which is apparently a degenerating form of cells shown in figure 1.

## SUMMARY

In the 5 cases presented the prodromal period ranged from two to fourteen days before jaundice appeared. Clinically the symptoms and signs were characteristic of those found in an attack of acute hepatitis. Splenomegaly was present in all patients. Enlarged lymph nodes were palpable except in case 3. This patient had a normal white cell count with a monocytosis. Leukocytosis with a mononucleosis was found in the others. The jaundice was hepatogenic and toxic in character. In the 3 patients (cases 1, 4, 5) in whom liver function studies were performed, cases 1 and 5 showed liver damage. All but 3 had a positive heterophile reaction. The symptoms, the majority of the

signs, and the abnormal laboratory findings except monocytosis completely subsided in fifteen to twenty-five days.

### CONCLUSION

These 5 cases of infectious mononucleosis in which jaundice was part of the clinical picture and the outstanding finding illustrate the various forms described by De Vries.

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# U. S. Army Veterinary Service in Australia

LIEUT. COLONEL STANLEY M. NEVIN
Veterinary Corps, United States Army

I shall attempt to set forth some observations made during about fifteen months' service in Australia, a huge country, in which the climate ranges from mildly temperate in the South to that of a tropical jungle in the North. The 7,000,000 people are mostly of English, Scotch, and Irish ancestry. The Australian soldier, tall, rangy, and rugged, can withstand tremendous hardships, as proved by his record in jungle fighting.

The Veterinary Service was organized and is administered by the Veterinarian, Office of the Surgeon, United States Army Service of Supply. Activities pertaining to the food inspection service are administered through the base section veterinarians, each of whom is responsible directly to the Veterinarian, S.O.S. Base section veterinarians have authority or responsibility concerning animals only in relation to forage inspection, construction and maintenance of veterinary station hospitals in their areas, and the embarkation or debarkation of animals through ports over which they have veterinary sanitary supervision. They handle no sick and wounded reports rendered by unit veterinarians situated within the base section area. These reports are rendered through veterinarians of higher tactical headquarters to the Veterinarian, S.O.S., who consolidates them for transmittal to The Surgeon General. Meat and dairy hygiene reports are consolidated by base section veterinarians and transmitted through the Veterinarian, S.O.S., along with personnel and other reports pertaining strictly to base section activities.

### SERVICE WITH ANIMALS

Animals obtained in Australia are purchased, processed, and issued by the quartermaster remount depot which is set up as an independent organization and functions under direct control of G-4, S.O.S. Veterinary sections arriving in Australia are placed on duty at the remount depot while awaiting activation of units to which they are to be assigned.

Glanders, infectious anemia, encephalomyelitis, and rabies are unknown in Australia and the health authorities see that

they are not introduced. When we operate in tropical areas, parasitic diseases give the most trouble, but our veterinarians have kept them under control.

No long forage is fed except on farms. The so-called chaff consists of oaten, wheaten, or alfalfa hay, chopped into ⅛- to ¼-inch lengths and baled into 60-pound bales. The wheaten and oaten hays are permitted to grow to maturity instead of being cut in the milk or dough stage. The stalks are hard and yellow and the grain is ripe. In effect, this chaff is a mixture of grain and chopped straw. Much of the grain falls out in the process and is recovered to be fed separately. In the Australian Army they feed about one-fourth to one-third lucerne chaff to grain chaff, mixed. A moderate amount of grain is fed separately. In many units the animals are fed five times daily.

Many civilian animals, particularly draft horses, which are used in vast numbers, receive only the grain chaff with extra oats the year round and remain in excellent condition. The chaff ration is easy to transport, handle, or store, and it can be fed in the field without waste. In my opinion, the grain chaff would be improved by earlier cutting of the grain, especially since ripe grain is added to the ration. This would obviate the necessity of adding alfalfa chaff and thus further simplify another procurement problem. Our Army has wisely adopted both the Australian type of forage and the nosebag for feeding it in the field.

## FOOD INSPECTION

All foods and forage were purchased through the Australian Army previous to 1943. The present procurement system provides for purchase by direct negotiation and contract, carried out in close cooperation with the director of Supply and Transport of the Australian Army, the Commonwealth Food Administration, price control authorities, and other government agencies. When contracts are let, base section veterinarians are supplied with copies of purchase orders and specifications and become responsible for inspection of all meat and dairy products purchased within their territories.

Since Australia owes its prosperity and development to its export industry, particularly animal products, the standards are high. The grading is extremely accurate and one seldom sees a product stamped out of its proper grade.

The Commonwealth of Australia Department of Commerce (C.A.D.C.) inspection is comparable to that of our Bureau of Animal Industry. One difference is, I gathered, that it has little responsibility for sanitation of premises, the latter coming under the supervision of the health department. Its inspectors are highly qualified and very cooperative. The chief inspectors and some assistants assigned to large abattoirs are regular five-year veterinary graduates; some abattoir assistants and those in charge of small bacon plants are graduates of two- or three-year courses at veterinary schools. In addition to these inspectors

there are many so-called State Inspectors, whose qualifications vary. State inspection is not acceptable to our Army. In districts where C.A.D.C. inspection is unavailable, class 1 and 2 inspection is carried out by officers of our Corps. At many outlying points on the continent and in New Guinea, cattle and sheep are being slaughtered for troops by Australian Army field butchering companies. All inspection at those places is done by officers of our Corps.

### MEAT PACKING

The municipal abattoirs and the large exporting plants are models of sanitation, are seldom more than two stories high, and cover a large space. Offal is carried away for processing at distant fertilizer plants. Australians go to great pains to beautify the grounds about the plants; however, the sanitation of some of the smaller bacon or sausage factories and provincial abattoirs, like that of some of our own, leaves much to be desired.

Fresh meat is plentiful in Australia and is not, so far as I know, rationed to the public.

*Beef.* Herefords and Shorthorns seem to be the most popular breeds of cattle. They are fattened entirely on grass. Since Australians hold that cattle will not fatten well on grass before reaching maturity, they let them grow until they are five or six years old. Therefore, while the beef may be well fattened and of excellent conformation, it usually tends to be coarser and tougher than our grain-fed young beef. Also the carcasses have a coarse and lumpy appearance, as they do not follow our practice of shrouding.

*Onchocerca gibsoni* infests about 80 percent of beef cattle from central and northern territories. The nodules are found in briskets and stifle joints. Stifle joints are opened at inspection of all carcasses, and the briskets are entirely removed from forequarters exported to England.

Cattle shipped by rail are roughly handled. In the southern and central abattoirs, where cattle are received mainly by rail, our rejections on account of bruises were much higher than for any other reason.

Conforming to local trade demands, beef cuts vary in use from those in this country. With the exception of the fillet, loin cuts are used almost exclusively for roasting. When the housewife calls for steak, she means round steak. It will be top round or bottom round (the latter called "silverside"), depending on price. In the smaller hotels and restaurants when steak is listed on the menu, it refers to round steak, though one may order any type of steak.

Packing of frozen, boneless beef for our Army, under our own specifications, is done under supervision of officers of our Corps stationed at contracting plants. They work in close cooperation with C.A.D.C. officials, who must place the Commonwealth stamp on each package accepted for export.

*Lamb.* Since Australia is essentially a wool-producing country and much of its export to the mother country calls for mutton, lamb is not as important in the local meat trade as is beef or cured pork. Our Army purchases some locally for use in camps and stations. The American soldier has let it be known far and wide that he does not like lamb; I think this is partly because earlier, when many of our troops were rationed by the Australian Army, they received a heavy diet of mutton which they thought was lamb. Many Australians have asked me if we eat lamb in America.

The Australians make a tasty and nourishing mutton stew for issue to their troops. The mutton is dehydrated, finely ground, and mixed with dehydrated carrots and peas.

*Pork.* Fresh pork is not popular in Australia, but cured pork products are widely used. The Hampshire appears to be the most popular breed, with quite a number of Chester Whites, all bred to bacon type. They do not feed corn; but barley, the commonly used fattening grain, results in firm and fine-flavored meat.

In the trade, the term "bacon" includes the entire side, pickled and smoked. These sides are from hogs weighing around 120 pounds. They remove the head, disjoint the legs at knee, and hock and cure the side in one piece. This would be the regular export Wiltshire side as trimmed in this country, except that no bones are removed. The grocer often buys this as a "side of bacon," and bones it out in his shop, but sells it in slices as ham or bacon, as the customer desires. For local rationing of troops the Australian Army uses this type of bacon. We used great quantities when rationed by their army.

The trade also uses a long-cut ham, cured separately, and sides of bacon cut similar to our dry salt, short-ribbed sides and given the regular bacon cure. The ribs and backbone are removed in the shop. Any slice of bacon purchased in a butcher shop or grocery store in Australia will contain Canadian bacon or "lean back" as well as regular American bacon all in the same slice. Bacon from clear bellies, as we know it, is not a trade item in Australia.

Bacon and ham purchased by our Army for storage and shipment conform to our American trim. This product and that cured and sold separately as ham and bacon in the trade are from larger hogs weighing between 190 and 250 pounds. We discovered that ham and bacon pickled by the old-fashioned absorption method would take the high temperatures and long smoke we required and would stand up better under tropical conditions than that produced by quick-cure methods. This product is larded, oil-papered, stockinet-wrapped, sewn in muslin, and packed in dry salt for shipment. Placing oat hulls 1 to 1½ inches thick about the product within the muslin sack is common practice, but makes the product too bulky and gives it no better keeping qualities.

*Small goods.* All edible by-products of the meat-packing industry, including organs and the various sausages, are called "small goods." We purchase these items only for local camps and stations. In some areas we had them make frankfurters to our own specifications. A popular item in the northern trade is a highly seasoned, fresh beef sausage produced in the same manner as pork sausage.

*Poultry.* Poultry is not a popular food in Australia. Generally, the only type on the market in quantity is the fricassee hens, past egg-production value. Some turkeys are marketed and we have purchased considerable quantities.

*Fish.* Fresh fish are not plentiful because of war restriction on fishing craft; however, we were able to purchase a weekly issue for most of our troops on the continent. The commonest varieties available were red snapper, white perch, and sun fish.

*Eggs.* Egg production and marketing are under control of state egg boards. Grading is very accurate and no trouble was encountered in obtaining the grade required.

*Canned meat products.* The canning industry is in its infancy but is expanding rapidly. Varieties of meats and products containing meats are about the same as in this country, with the exception of chili con carne, which is not in demand in Australia. Products peculiar to Australia, such as "camp pie" are canned in great quantities. Many of the large canneries have most modern and efficient machinery and methods.

Australian canned corned beef is of high quality; however, because of grade surpluses at certain times, they have used too high quality of beef. The result is a very rich product which contains too much intramuscular fat and does not "firm-up" well in the can at ordinary temperatures. All canned meat products being put up for our Army are inspected during manufacture by officers of the Veterinary Corps.

## DAIRY PRODUCTS

In the large cities are the most up-to-date dairy plants. Dairy sanitation in the provincial centers is generally only fair. Tuberculin-testing programs have been carried out from time to time by the Commonwealth and the state governments but have been somewhat curtailed during the war. They have nothing analogous to our accredited herd plan as a national program. Milk producers and butter and cheese producers have large cooperative associations throughout the country. Many associations have carried out 100 percent tuberculin and Bang's disease testing. Fresh milk which has been tested is obtained for our troops in all cases. Milk for the large cities is collected by so-called cooling stations at points on transportation lines throughout the milkshed. There it is cooled to 40° F. and shipped in stainless steel tank cars to pasteurizing plants in the city. The various tests are made on the product of each producer at the

cooling station, where an agent of the Milk Board remains on duty. Milk is again tested at the plant before and after pasteurization. Each state has its own milk board in addition to the municipal health boards of the cities.

Butter, being an export item, must conform to a high standard. The minimum standard is much higher than in our country. The cheapest back-alley "hash house" in Australia has no fresh butter scoring less than 90. They produce an excellent canned butter, but we found it did not stand up under field conditions in the tropics. Up to the time I left, we were using a fine grade of canned margarine which had excellent keeping qualities.

Cheese of good quality, similar to our Cheddar but lighter in color, is produced in great quantities and is a heavy item in the Australian Army ration. These cheeses are cured in Cheddars of 10, 25, and 50 pounds. We purchase only for troops on the continent. Defects found on inspection are about the same as those encountered in the United States, such as gassy, acid, rubbery, crumbly. Edam, Gorgonzola, and some processed cheeses of fair quality are found on the market.

Two by-products of the dairy industry, namely, cottage cheese and buttermilk, are not trade items. Buttermilk is not used as a beverage in Australia. A small amount of cottage cheese is made locally in restaurants and delicatessens. The quality is only fair.

## MISCELLANEOUS NOTES

In a land where nature provides more formidable obstacles, logistical problems of other wars fade into insignificance by comparison. Supply at the battle of Buna was a feat that will live forever in the annals of military achievement. The veterinary officer played a part in that action just as surely as the fighting soldier whom he helped to feed. In a climate where boots mold overnight, where metal, unprotected by paint or lacquer, will rust through rapidly, where the moist heat of the steaming jungle penetrates all types of protective coverings, one can understand how only the constant vigilance of our inspectors can assure wholesome, unspoiled foods for men on the firing line.

All cans containing food products must be thoroughly lacquered. Even one tiny spot left bare on any part of the can will rust through in a very short time. One "blower" in a stack will cause spoilage of many surrounding cans. Therefore it is essential to stack in a way to make all parts as available as possible, to carry out constant inspection, and to remove spoiled cans before they burst and contaminate others.

Canned goods received in Rock Fastener type boxes were less damaged by rough handling than those in solid, nailed boxes, wire bound. Solid boxes with steel straps held up better than the wire bound, but not so well as the Rock Fastener type; however, boxes having straps set near the ends sustained less damage

than those on which straps were set farther in from the ends.

Pork luncheon meat in 6-pound oblong cans did not ship well. The contents were too heavy for the weight of tin. The least tap crimped the end edges and "swellers" resulted. Class 9 rejections on that item were extremely heavy. Products received in glass jars sustained heavy breakage. Products received in steel-strapped fiber boxes sustained heavy damage after having been exposed to rain. Wetting softens the fiber and subsequent rough handling tears the boxes badly. If kept dry, they hold up well. Canned bacon kept well at all temperatures. Canned powdered whole egg was found to be in excellent condition after more than twelve months' storage in warehouses that frequently ran over 100° F. in temperature.

The field artillery pack, including animals, personnel, guns, and all equipment can be moved handily by air. Mules and horses travel well in cargo planes, cross-tied by twos in tandem.

The Phillips cargo-type packsaddle is unsuitable for smaller type pack horses. They cut their stifles on the lower rear corners. Also it is too heavy when wet. The Australian Army packsaddle is more suitable for the smaller animals. It is practical to ship milch goats from Australia to New Guinea to provide fresh milk for hospitals. They can live on the country; cows cannot.

Railroads through the various states are of different gage. In shipping across the country, goods must be reloaded at each boundary instead of merely switching cars, as would be the case with standard gage. In Australia all motor traffic moves on the left side of the street or road.

In handling cattle, no ropes are used. The cattle are driven with whips and trained cattle dogs. Branding and other work are done in pens on the cattle station. The stock saddles have no horn. They are built somewhat like our training saddle, except for a deeper seat and higher pommel and cantle. Projecting inward from the pommel are two leather-covered metal flanges, under which the rider's thighs fit. The horses are very handy, like our own cutting horses. They are better bred, containing more thoroughbred blood than our western stock horses.

The Australians are amazed at the high quality and variety of our field rations, particularly the jungle ration. After experience in France in the last war and again with an overseas army in this war, I am convinced that the American is the best-fed and best-equipped soldier in the world.

## CONCLUSION

The veterinary service in Australia is efficiently organized and functions smoothly. Cooperation between the two armies and between our people and the civilians is excellent. The framework is laid for any amount of expansion. Any sudden increase in military activities in that part of the world will find the Veterinary Corps on the job and ready to go.

# Apparatus and Clinical Notes

## CUTANEOUS HYPERSENSITIVITY TO TEAR GAS (CHLORACETOPHENONE)

MAJOR MILTON KISSIN
Medical Corps, Army of the United States
and
CAPTAIN MILTON MAZER
Medical Corps, Army of the United States

Large numbers of soldiers have been exposed to tear gas during training against chemical attack and while a few instances of cutaneous hypersensitivity to chloracetophenone have been reported,[1] [2] at our station, among more than 10,000 individual exposures to chloracetophenone only one resulted in a significant reaction.

The patient was an aviation cadet, twenty-five years of age, whose first exposure to tear gas occurred on 1 Aprli 1943. He entered the gas tent. wearing a gas mask, but removed it before leaving the tent. The day was cool, the exposure occurred in the early morning, and he experienced no reaction of any kind. The second exposure was on 15 June 1943 when he walked through a gas cloud in the open while masked. The exposure occurred during the cool of the morning. At 4:00 p.m. the next day he noted itching and an erythematous raised eruption on the hands and trunk. He was not hospitalized and the eruption disappeared in four days. The third exposure occurred on 8 July 1943 in a gas tent. He entered the tent masked to listen to a short talk. After a few minutes he left the tent, removed his mask, re-entered, and re-applied the mask. He estimated the total exposure while masked at six to seven minutes, and unmasked at a few seconds. The exposure occurred at 4:00 p.m. A skin reaction did not develop either immediately or after vigorous physical exercise, which he performed soon after the exposure. Three hours later he had generalized burning and itching of the skin; ten hours after exposure, he observed an eruption on both forearms; seventeen hours after exposure, he was admitted to the station hospital. The entire body except for the face was involved in an erythematous urticarial eruption. The patient gave no definite history of allergic disease. There was a questionable history of pruritus after ingestion of strawberries. A paternal aunt had hay fever and another aunt had eczema.

On 16 July 1943, a patch containing powdered chloracetophenone was applied to the left forearm. It was removed in ten minutes because of a severe local burning sensation. At the site of the patch test there appeared the next day a bleb about 5 cm. in diameter and 1 cm. high with a large surrounding area of erythema. A recrudescence of the subsiding lesions on the trunk and extremities also occurred. Two normal subjects were used as controls for the patch test. On one the chloracetophenone was applied for ten minutes, and on the other for two hours; the former developed an area of erythema 0.5 cm. in diameter, which persisted for several days; the latter developed a bleb 1 cm. in diameter with circumferential erythema 3 cm. in diameter. The patient's eruption disappeared slowly and was gone

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1. Queen, F. B., and Stander, T.: Allergic Dermatitis Following Exposure to Tear Gas (Chloracetophenone, CN), J. A. M. A., 177:1879, 29 Nov. 1941.
2. Ingram, J. T.: Dermatitis from Exposure to Tear Gas, Brit. J. Dermat. Syph., 54: 319-321, Dec. 1942.

eleven days after exposure. The lesion produced by the patch test resolved more slowly and on 17 August 1943, still showed slight erythema with a central area of scarification. A few weeks later both control subjects were twice exposed to chloracetophenone gas in the field, but neither showed a reaction.

Chloracetophenone gas may cause immediate cutaneous burning and erythema when the environmental temperature is high and the skin is moist.[3] This type of immediate reaction, however, did not occur in our patient. After the first exposure, there was no skin reaction; after the second exposure, a mild dermatitis appeared within thirty hours and lasted four days; after the third exposure, a severe dermatitis appeared within ten hours and lasted ten days. This sequence of events suggests that the patient's skin was sensitized by the initial exposure. Further proof of hypersensitivity to chloracetophenone was offered by the violent local reaction to the patch test with recrudescence of the eruption on the trunk and extremities.

3. Treatment of Casualties from Chemical Agents, War Department Technical Manual 8-285, p. 21, 27 November 1942, U. S. Government Printing Office.

## UNDERWATER TREATMENT TANK

CAPTAIN ARTHUR M. PRUCE
Medical Corps, Army of the United States

Hydrotherapy is of value in diverse types of injury treated in the physical therapy section of a general hospital. Arm and leg whirlpool baths which are standard items of issue to station and general hospitals are valuable is most instances, but only the distal joints, elbow and wrist in the upper extremity, and knee and ankle in the lower extremity can be immersed. In injury to the back, hip joint, upper thigh, or shoulder joint and upper arm, the leg and arm whirlpool baths are inadequate. Only when the body is completely immersed are these joints accessible to treatment. The need for an underwater tank of the Hubbard type led to the construction of a simple unit made entirely of nonessential materials at the Stark General Hospital. The wooden frame and metal lining can be made at a total cost of about $140 for labor and materials. A motor-driven agitator, which is an item of issue, increases the therapeutic value.

This unit has been effective in:

1. Acute and chronic low back strain.
2. Gunshot wounds of hip and shoulder.
3. Fractures:
   (a) Shoulder and upper arm, hip, and thigh.
   (b) Multiple fractures of extremities.
   (c) Multiple rib fractures.
4. Shoulder dislocations following open and closed reduction.
5. Burns:
   (a) Acute, involving large parts of the body.
   (b) Chronic burn ulcers involving extremities.
6. Following plastic surgery to the axilla.
7. Peripheral nerve injuries in lower extremity.

Because of lack of space, figure 1, showing a patient in the tank, has been omitted.

A Bradford frame is used to lower the nonambulant patient into the tank and support him in the water, and an inflated rubber cushion with open center is an effective headrest. An even temperature level is maintained by using an ordinary bath thermometer.

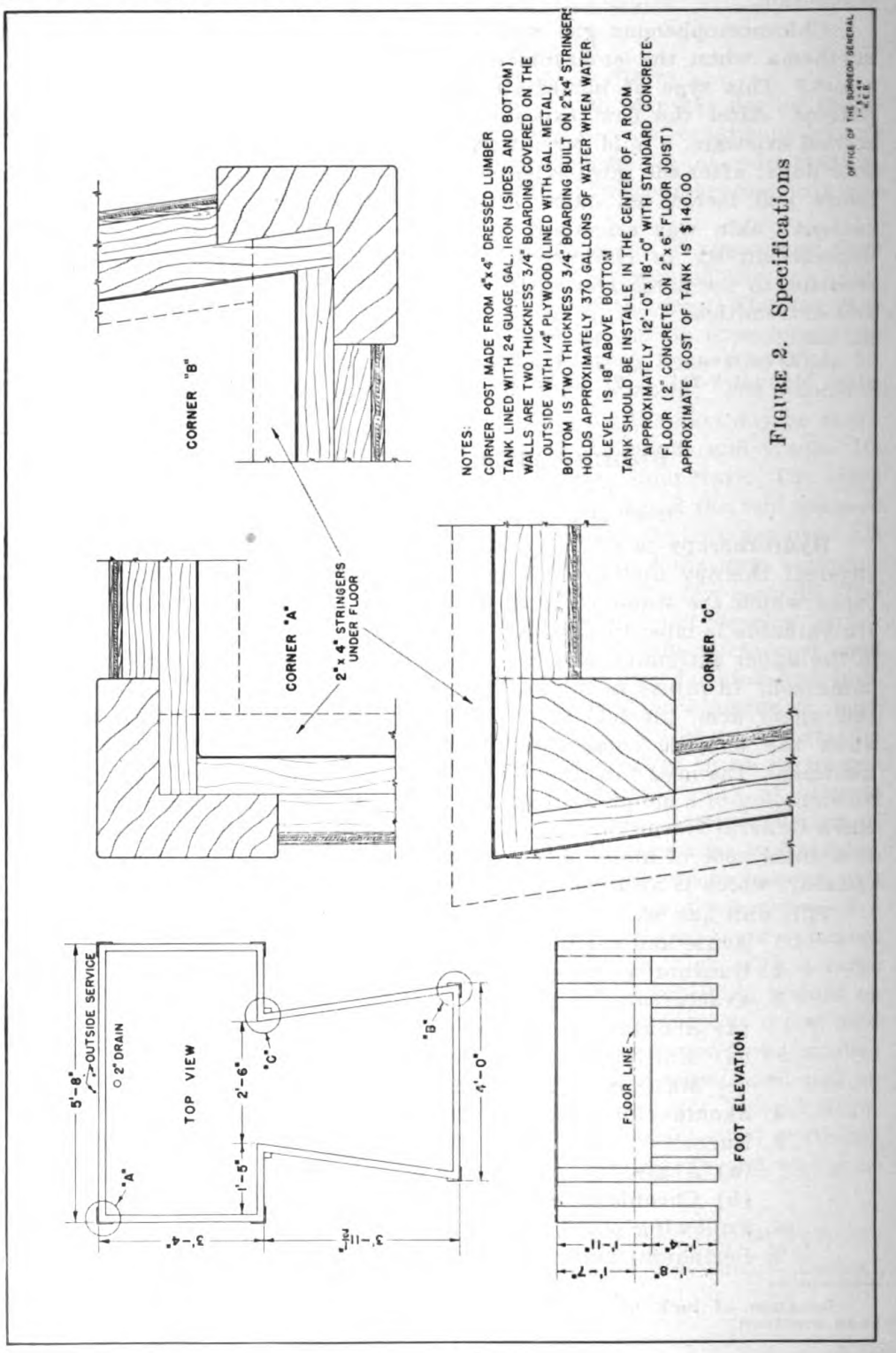


FIGURE 2. Specifications

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Carlisle Barracks, Pa., 9-1-44—78,200